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Beyond occupation: The evolution of gender segregation over the life course†

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Abstract

We argue that gender segregation stems from sources beyond occupation, the traditional domain of study: women and men differ not only in their occupational allocation but also in their time involvement in paid work, in their decisions to participate in the labor market at all and in their retirement age. We pool 21 Labour Force Surveys for the United Kingdom to measure and compare these various forms of segregation (occupational, temporal and economic) over the 1993-2013 period (n = 1,815,482). The analysis relies on the Strong Group Decomposability property of the Mutual Information index to add up all forms of segregation and to identify the evolution of segregation over the life course net of cohort and period effects. There are two main findings. First, over the life course, the evolution of gender segregation parallels the inverted U-shaped pattern of the employment rate. When workers are younger, measures of all concepts of segregation are small. Then, gender segregation increases due to a combination of economic and time-related components. After the prime childbearing years, gender segregation remains fairly stable for approximately 15 years, sustained by expanding occupational segregation; finally, in the later years, gender segregation decreases substantially. Second, gender segregation is consistently 20% higher than occupational segregation after the teenage years. However, as much as 44% of gender segregation at age 35 and 52% at age 64 would remain even if occupations were completely desegregated. These ages correspond to two key stages in the life course: career and family building on the one hand and retirement on the other.

JEL:
Keywords: employment, gender, life course, Mutual Information index, occupations, part-time, retirement, segregation

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Beyond occupation: The evolution of gender segregation over the life course *

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Abstract

We propose a measure of gender segregation over the life course that includes differences between women and men in occupational allocation, degree of time involvement in paid work and their participation in one or another form of economic activity and inactivity, such as paid work, family labor or retirement. We pool 21 Labour Force Surveys for the United Kingdom to measure, compare and add up these various forms of segregation–occupational, temporal and economic–over the 1993-2013 period ($n = 1,815,482$). The analysis relies on the Strong Group Decomposability property of the Mutual Information index. There are four main findings. First, the marketplace is the major contributor to gender segregation. Second, over the life course, the evolution of gender segregation parallels the inverted U-shaped pattern of the employment rate. Third, there is a tradeoff between occupational and non-occupational sources of segregation that defines three distinct stages in the life course: the prime childbearing years, the years when children are of school age and the retirement years. Fourth, to a large extent women's heterogeneity drives the age patterns in segregation.

Keywords: employment, gender, life course, Mutual Information index, occupations, part-time, retirement, segregation

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Gender scholars have proposed several overarching accounts of gender that portray it as an "order", "social structure", "system" or "institution" (see Connell 1987, Risman 1998, Ridgeway and Correll 2004 and Martin 2004, respectively). One of the pillars of the "gender order" is the allocation of paid and unpaid tasks to women and men (Connell 1987), i.e., gender segregation. Given women's growing participation in the labor market and the availability of detailed data on occupations in official statistics, the measurement of gender segregation, starting with Gross's (1968) pioneering article, has mostly focused on the uneven distribution of women and men over occupations in the marketplace (see, for example, Flückiger and Silber 1999 and Steinmetz 2012 for two literature reviews).

This framing of the research agenda fits the main activity of men in their core working years, the majority of whom are in full-time employment from their early twenties to their late forties. However, women of working age live a more complicated story (Acker 1988). Many are engaged in housework and childcare full time or combining work at home and in the marketplace via reduced-hour employment (Bianchi, Robinson, and Milkie 2007; Cooke 2011; Gornick and Meyers 2003; Jacobs and Gerson 2004; Pettit and Hook 2009). These well-known facts about the gender order have motivated some researchers to incorporate into their measure of segregation the degree of time devoted to paid work (see, for example, Elliott 2005) and the gender gap in the rates of people looking after their families full time (Cohen 2004). Because women concentrate in reduced-time jobs and family labor, the inclusion of these dimensions in the analysis would typically increase the observed level of segregation.

However, other sources of segregation exist in connection with the individual's broad relationship to the labor market, such as gender differences in unemployment rates (Azmat, Güell, and Manning 2006). Some other non-market sources of segregation become salient at stages in the life course that do not coincide with the core working years. For example, many in the younger population are full-time students, while the proportions of the permanently sick and retirees grow in the later years. Combined with unpaid domestic work, these are the most relevant "economic statuses", or forms of economic activity and inactivity, that official statistics usually record for respondents who are not in paid

employment.

In this article, we propose a measurement framework that is capable of identifying (a) "economic segregation", i.e., the segregation that stems from disparities in the gender distribution over multiple economic statuses, and (b) "market segregation", i.e., the segregation that originates because the women and men in the economic status of "paid work" tend to work a varying number of hours in different occupations. We reserve the term "gender segregation" for the weighted sum of economic and market segregation. Furthermore, the same framework allows for the identification of gender segregation—and its components (a) and (b)—as people age and change occupations, time arrangements and economic status. These shifts may take place rapidly such as when, over the span of a few years of age, a large portion of the population transits from learning to earning, then becomes parents and, ultimately, retirees. Our identification strategy controls for cohort and period effects.

A gender segregation index measures how differently women and men distribute over a set of organizational units (Flückiger and Silber 1999). We show that a segregation index that satisfies the Strong Decomposability (SD hereafter) property allows us to accomplish the two tasks just described: adding segregation in economic statuses and in the marketplace, as well as identifying segregation for each year of age net of cohort and period effects. Essentially, a segregation index satisfies the SD property if, for any partition of the organizational units into clusters, the overall segregation can be expressed as the sum of (a) a between-group term, capturing the uneven distribution of men and women over the clusters, and (b) a within-group term, which is the weighted sum of the segregation indices within the clusters with weights equal to their demographic importance. We use the Mutual Information index (the M index hereafter) because it is the only multigroup segregation index that, together with other desirable properties, satisfies the SD property (Frankel and Volij 2011).

To illustrate our approach, we revisit the case of gender segregation in the UK, a country with a long tradition of gender segregation studies and for which large datasets are available. In particular, we analyze 21 cross-sections of data drawn from the UK's Labour

Force Survey (LFS) from 1993 to 2013 to describe the evolution of gender segregation over the life course; we consider ages 16 to 69 ($n = 1,815,482$).

1 Definitional questions

In this section, we first define the concept of the life course as used in this article. We then present the notions of segregation that add up to the overall concept of "gender segregation": market segregation—and, within it, occupational and time segregation—and economic segregation. We end the section by arguing that the weighted sum of economic and market segregation quantifies the extent of gender segregation in domains of life related to the labor market.

1.1 Aging and the life course

The concept of the life course has multiple meanings (Alwin 2012). In this article, we follow Elder's canonical and oft-quoted definition of the life course as a set of "age graded life patterns embedded in social institutions and subject to historical change" (Elder 1994). In our empirical illustration with UK data from 1993 to 2013, our emphasis is on the first part of Elder's statement. As we will see, although there were various demographic changes over the 21-year period between 1993 and 2013, there was no fundamental change in the so-called "one and a half" breadwinner model that has defined gender relations in the UK since the expansion of women's paid employment into part-time jobs in the 1980s (Lewis, Campbell, and Huerta 2008). Instead, it is reasonable to hypothesize that the embedding of women and men within the social institutions of the educational system, the family, and the market, to use Settersten's phrase (2003), shapes the contours of their lives as they age.

Traditionally, there has been an expectation of a "lock-step progression" through schooling, full-time paid employment and retirement that many individuals, especially women, fail to actually fulfill (Moen 2005). Through most of the 1990s and 2000s, women kept pace with men through the education phase. However, as soon as schooling ends,

the life stages of many women, but not those of men, are defined by both family labor and wage earning (Brückner and Mayer 2005). Consider the childbearing period that many people in their twenties and thirties experience. Knowing that child care would fall on them early in their lives, some women choose to be economically inactive or to work only in part-time jobs throughout their adulthood—a choice shaped, among other things, by institutional constraints (Pedulla and Thébaud 2015), and widely shared cultural beliefs, social expectations and norms (Benard and Correll 2010; Cech 2013). Other women opt to work full time in the marketplace from which they nonetheless withdraw, partially or entirely, during their childbearing years (Nitsche and Grunow 2016; Stone 2008). Now consider the process of retirement from wage labor that occurs in significant numbers among people in their sixties or earlier (Blundell and Johnson 1998). Gender gaps in retirement age (Dahl, Nilsen, and Vaage 2003; Radl 2012), the incidence of poor health among older individuals, and the combination of retirement and reduced hours of paid work (O'Rand and Henretta 2000; Lain 2012) open up other channels that connect segregation with the retirement stage, albeit in directions that are difficult to predict.

Briefly, our lives are gendered from the cradle to the grave (Arber and Ginn 1991; Lorber 1994). In the literature to date, there are two ways of studying the evolution of segregation as people age. One strategy consists of the age-profiling of segregation in one or multiple cross sections of data (see, *inter alia*, Jacobs 1989, Chapter 2, and Dolado and Felgueroso 2004). However, for any cross-section, a given age is coterminous with a given birth cohort. For example, people aged 40 in the year 2015 belong to the cohort born in 1975. Therefore, at least some of the effects that we attribute to being 40 years old may be caused by historical contingencies experienced by the 1975 cohort at that age.

Another approach studies segregation as one or more birth cohorts grow old (see, for example, Blossfeld 1987 and Jacobs 1989, Chapter 6). In this case, age and period are perfectly confounded: individuals in the 1975 birth cohort turned 40 in 2015. Accordingly, at least some of the effects that we credit to age may instead be traceable to historical events in 2015. In conclusion, both procedures are unable to identify the effect of age, and therefore, *sensu stricto* cannot characterize the evolution of segregation over the life

course.

In summary, despite these and other antecedents in the case of occupational segregation (Chan 1999; Jacobs 1995; Trappe and Rosenfeld 2004), there is little in the way of a life course perspective in the study of gender segregation. Most life course research has focused on the sequencing of life stages with limited attention paid to gender differences. When it has attempted to study gender differences, age, cohort, and period effects have been confounded. In the Methods section, we explain how the M index helps identify the level of segregation at each age net of cohort and period effects.

1.2 Market segregation

Employed individuals work for pay for a number of weekly hours in a given occupation. In other words, as illustrated in the second column of Table 1, a job can be characterized by an occupation *and* a degree of time involvement or a time requirement. The number J of occupations in official statistics varies across countries and over time. For example, the 2010 Census Occupational Classification used by the Current Population Survey in the US includes 535 detailed occupations; the current International Standard Classification of Occupation (ISCO-08) designed by the International Labour Organization (ILO) has 130 occupations at the three-digit group level; and the Standard Occupational Classification for the 2010s of the British Office for National Statistics (ONS) distinguishes 90 occupations at the so-called "minor-group level" (ONS 2010). We denote by L the degrees of time involvement. In the Data section, we present the three occupational classifications in use during the 21 years of data that we analyze, as well as the four categories of time requirement that we distinguish in the article.

[Table 1 about here.]

In the context of Table 1, studies that identify gender segregation with the traditional notion of occupational segregation gauge the uneven distribution of men and women over the J occupations (two recent examples are Cortes and Pan, forthcoming, and Levanon and Grusky 2016). In this article, we are concerned with the joint effect of occupations

and time on gender segregation in the marketplace. We call this joint effect "market segregation". Its measurement captures the uneven distribution of women and men over the product of J occupations and L degrees of time involvement or, simply put, $J \times L$ labor market categories. Imagine a situation whereby we distinguish (a) 90 occupations ($J = 90$) and (b) full- and part-time employment ($L = 2$). Then there would be $90 \times 2 = 180$ labor market categories.

The decomposability property of the M index allows us to separate the effects of occupational allocation and varying time requirements on market segregation. We refer to the effect of occupations, controlling for time, as "occupational segregation". For its part, we term "time segregation" the effect of time requirements, controlling for occupations. As we discuss in the Methods section, the M index can be decomposed into the part that is unambiguously attributable to each source and the part that cannot be solely attributed to either occupations or time. We refer to the latter as the "interaction term". It can be positive or negative. When the interaction term is positive, both occupation and time requirements work "in the same direction", so to speak. When the interaction is negative, these sources of segregation work "in opposite directions" such as when there is overrepresentation of women in full-time female jobs or of women in part-time male jobs (see Guinea-Martin, Mora, and Ruiz-Castillo 2015 for a discussion of the interaction term in the context of gender vs. ethnic segregation). The decomposition of the M index in expression (1) summarizes our strategy:

$$\text{Market segregation} = \text{Time segregation} + \text{Occupational segregation} + \text{Interaction term}. \quad (1)$$

Research on the infuence of reduced-time work on occupational segregation is plentiful, especially for Europe. However, to the best of our knowledge, no study has yet separately estimated the two sources of market segregation, controlling for the effect of the other, or the interaction term in expression (1). Instead, scholars have accounted

for the time dimension in studies of occupational segregation only indirectly.[1] Moreover, these contributions are based on non-decomposable indexes that cannot separate the segregation fueled by occupations from that originating in different degrees of labor market involvement.

Elliott (2005)—and its sequel by Guinea-Martin, Blackwell, and Elliott (2010)—offers the only attempt to directly weigh the salience of the time divide using the decomposition of Theil's H index, a normalized version of the M index (Mora and Ruiz-Castillo 2011). She partitions the population into men, on the one hand, and women in either full- or part-time employment, on the other. With this setup, overall occupational segregation is expressed as the sum of two terms. The first term measures the segregation that arises from women and men's uneven distribution across occupations. The second term gauges the disparity in the distribution across occupations of women in full- and part-time employment. In this way, Elliott extends the usual approach to measuring occupational segregation. She concludes that in the UK of the early 1990s, 14% of the occupational segregation among people aged 16 to 55 stems from the occupational differentiation between women in full and part-time work (vs. 11% in the US). However, this research strategy ignores time divisions among men and between women and men. It thereby precludes the analysis of what we call time segregation, as well as the interaction between the two sources—occupations and time requirements—of market segregation.

1.3 Economic segregation

Moving beyond the market to include all women and men in a measure of segregation requires considering all possible forms of economic activity and inactivity or, for short, economic statuses. In practice, the exact nature, number and definition of the alternatives depends on the statistical information available in a given country at a given moment in

[1]For example, Holden and Hansen (1987) and Sparreboom (2014) measure separately segregation in full- and part-time jobs; Hakim (2004) and Watts and Rich (1992) compare the occupational segregation of women and men in full-time employment with that of part-timers; Fagan and Rubery (1996) compare the occupational segregation of all workers with the segregation of full-timers; Blackwell (2003) and Blackwell and Guinea-Martin (2005) contrast the occupational distribution of men with that of women in full-time employment, on the one hand, and with that of women in part-time employment on the other; and Elliott (2005) and Guinea-Martin, Blackwell, and Elliott (2010) compute occupational segregation between women and men, as well as between women who are employed full and part time.

time. Currently, most national statistics bureaus follow the guidelines of the ILO and class as "inactive" anyone who is not in the "labor force". Moreover, many bureaus further distinguish types of "economically inactive" people. Four groups are notable. The first is people responsible for unpaid household chores and caring-taking activities. Following Folbre (1994), we refer to tasks of this type as "family labor". The second is the group enrolled in education, which is classed as "studying". A large portion of the members of this category falls into the younger range of the population. The third and fourth are the "permanently sick" and "retired from work" categories. Most people in these categories belong to the older population.

The first two types of "economic inactivity"—studying and family labor—concern activities that carry no pecuniary reward, whereas the last two—permanently sick and retired—do not necessarily entail any work but are oftentimes associated with pay or an allowance. This distinction highlights the purpose of official classifications of economic status, which is the individual's broad relation to the labor market or "labor force attachment". Most of the permanently sick and retirees develop their entitlement to payment based on their past employment history. By contrast, students and homemakers typically have either no or more sparse labor market experience.

However, the priority of modern labor force surveys lays elsewhere. Serving the country's economic policy, their main goal is to record the portion of the civilian non-institutional population who, in the week prior to the survey, worked for pay for at least one hour (the employed) or were searching actively for a job and available to take on one (the unemployed; see, for example, Carter 2006). "Paid work" and "unemployment" are the two possible economic statuses of people in the labor force, i.e., the economically active.

The first column of Table 1 lists the six typical distinctions of the economic status of the population presented thus far. The uneven distribution of women and men across these categories gives rise to the sort of segregation that we label "economic".

1.4 Gender segregation

Let us recap succinctly. Table 1 lays bare the conceptual distinction that is the mainstay of our approach: on the one hand, we have the economic statuses that classify the entire civilian non-institutional population, and on the other, we have all combinations of occupations and time requirement—which for brevity we refer to as jobs—held by the subset of the population in paid employment in the formal economy. The exact categories that make up each of these two dimensions are the actual bricks and mortar upon which the analysis is built—the "organizational units" along which women and men distribute more or less unevenly. The nature of these units is contingent on the statistics available to the researcher. (We present ours in the Data section.) However, beyond classificatory details, we have thus far proposed to gauge the uneven distribution of women and men across economic statuses and to call this measurement "economic segregation". Furthermore, we have proposed to weigh the uneven distribution of the women and men in paid work across labor market categories and to call the result "market segregation". The addition of these two measures would quantify the extent of overall gender segregation that there is in the key dimensions of society related to the labor force attachment of women and men. We call this notion of segregation "overall gender segregation", or "gender segregation" for short. The question, though, is how do we actually implement it? How can we add the economic segregation of the entire population to the market segregation of only the employed population?

An illustration with two ages, eighteen and twenty-two, will help explain our answer. Suppose that people of either age are gender-balanced and equal in every respect except their employment rate: 70% of the eighteen-year-olds are in paid work vs. 80% of the twenty-two-year-olds. Assume that they all have the same economic segregation, say X. Finally, among the employed, assume that women and men of both ages are equally distributed over time requirements and occupations, such that they have the same market segregation, say Y. In so far as the employment ratio is larger for older people, it is reasonable to expect that the market component of overall gender segregation is also greater for them. This is exactly what we obtain since, as we explain in the Methods

section, the M index allows us to express gender segregation as the sum of (a) economic segregation and (b) market segregation scaled down by the employment rate:

$$\text{Gender segregation} = \text{Economic segregation} + \text{Employment rate} \times \text{Market Segregation}. \quad (2)$$

Because the employment rate is higher among the older people, the market component of overall gender segregation in expression (2) is also larger for them, $0.80 \times Y$, vs. $0.70 \times Y$. Moreover, it also follows that overall gender segregation is higher among the twenty-two-year-olds than among the eighteen-two-year-olds: $X + 0.8 \times Y > X + 0.7 \times Y$.

The connection between gender inequality and the division of labor between home and market has long been emphasized (see, inter alia, Acker 1988, Chafetz 1988, Cooke 2011, Crompton 2006, Damaske 2011, Gornick and Meyers 2003, Glucksmann 1995, Lorber 1994, Pettit and Hook 2009). However, to the best of our knowledge, there is only one alternative to expression (2) in the current literature on the overall segregation of women and men. Cohen (2004) originally proposed it, and Hook and Pettit (2015) have subsequently adopted it. These authors calculate the Dissimilarity index (DI hereafter; see Duncan and Duncan 1955) on a set of organizational units that includes an additional category—either "keeping house" (Cohen 2004) or "not in the labor force" (Hook and Pettit 2015)—as if it were yet another occupation in the marketplace.

With this framing, and using CPS data from the early 1970s, 1980s and 1990s, Cohen (2004: Table 3) reports that the inclusion of family labor—an activity where many women but only a few men concentrate—increases the level of gender segregation for people aged 25 to 54 by 9 to 12 points, depending on the years considered. For their part, Hook and Pettit (2015: Table 2) calculate the DI for eleven countries on a sample drawn from the Luxembourg Income Study for women and men aged 25 to 49. They report that in 2004 the level of segregation in the US slightly decreased when people not in the labor force were included (0.342) as compared to the DI for the employed population (0.346). (Instead, in the same year in the UK, the country of study in this article, the DI was 0.337 in the overall population but only 0.283 in the employed population.)

Our approach, summarized in expression (2), is inspired by these contributions but also expands on them substantive and methodologically. Substantively, we posit two considerations. First, there is segregation beyond paid work and family labor, the two domains that Cohen (2004) studies. The life course approach brings to the fore forms of economic activity, such as unemployment, and of inactivity, such as studying and retirement, that may alter the contours of segregation as women and men grow old. Second, as argued earlier in the section on economic segregation, there might be segregating heterogeneity within the broad category "not in the labor force" used by Hook and Pettit (2015). Erasing distinctions in the gender gap and relative sizes of categories of inactivity such as family labor and permanent sickness, to name only two, may cancel out their contribution to the DI. This fact could explain why, in Hook and Pettit's (2015) analysis of some countries, segregation actually declines when people not in the labor force are included.

Methodologically, once we recognize that there are two sources of gender segregation—economic statuses and labor market categories—the addition of a between term and a within term—capturing the economic segregation of the entire population and the market segregation within the employed population, respectively—makes mathematical sense only for additively decomposable segregation indices. Since the DI does not have this property, its use does not allow us to integrate the two types of segregation that we consider.

In the next two sections, we describe the data and introduce the M index and the SD property. In the Results section, we start with expression (1), querying the roles that occupations and time play in market segregation. Next, we focus on expression (2) and explore the contribution of market-generated segregation and economic status to the overall segregation of women and men. Throughout the presentation, we describe the evolution of gender segregation and its components over the life course. In the final section, we discuss the significance of our results for the literature on segregation and propose avenues for future research.

2 Data and methods

2.1 Data

We analyze pooled cross-sectional data for the population of the UK aged 16 to 69. The source is the LFS spring quarter from 1993 until 2013 ($n = 1,815,482$).[2] The LFS is the fagship survey for labor market outputs in the UK. It samples approximately $80,000$ households each quarter. We analyze the spring quarter because it is the least influenced by seasonal variation. Moreover, we study the period between 1993 and 2013 because 1993 is the first year with comparable information for all the variables of interest. With these data, our analyses produce arrays of indexes with $69 - 16 + 1 = 54$ rows, one for each age, and $2013 - 1993 + 1 = 21$ columns, one for each year.

Ideally, we would study segregation over the life course with longitudinal data. Unfortunately, there are no longitudinal data with a long enough observation period for our purposes.[3] Still, it is well known that even with longitudinal data, age, cohort and period effects cannot be identified simultaneously. Hall, Mairesse, and Turner (2007) note the need for empirical tests or *a priori* information to ignore two of these dimensions and identify one. Consider the following three possibilities of introducing *a priori* assumptions to solve the identification problem. For illustration purposes, in Table 2, we include only three broad age groups, young, middle-aged and older individuals, and three independent cross-sections. The first possibility consists of treating the columns in Table 2, that is, the independent cross-sections, as if they referred to the same population observed at different moments. Researchers making comparisons over time with cross-sectional data typically adopt this assumption. In the second possibility, some researchers construct "pseudo-cohorts" by taking the rows as if they referred to the same population observed

[2]Downloaded on July 13, 2014, from the UK *Data Service* at `http://ukdataservice.ac.uk`. Scholars can apply to access the LFS data through the UK *Data Service*. We alone are responsible for the interpretation of the data presented herein.

[3]The longest-running longitudinal study in the UK, the British Household Panel Study (BHPS), includes 18 years of data for the period from 1991 to 2008. Given that individuals are followed for up to one-half of their life course, we would need to impute values for the remaining part based on results from other cohorts—just as we do for pooled cross-sections. Additionally, the BHPS sample size is approximately $10,000$ people, which is too small to reliably estimate segregation indexes with detailed occupations, time involvement and economic status classifications.

over the entire life course. The middle row of Table 2 is one example of a pseudo-cohort comprising young, middle-aged and older people drawn from cross-sections 1, 2 and 3, respectively.

[Table 2 about here.]

We favor a third stance that serves our goal of studying gender segregation over the life course: we pool the data for each age group diagonally across cross-sections as if they referred to the same population of a given age. Each age group has its own diagonal. In Table 2, we highlight the diagonal corresponding to the middle-aged group using shaded cells. Of course, in reality, these data arise from three independent sets of middle-aged people that are sampled at different times. In the Methods section, we explain how we aggregate the indexes calculated for each age across cross-sections in a manner that allows us to identify the impact of age net of cohort and period effects.

2.1.1 Variables

In addition to the age of the individual in years, we consider the degree of labor market involvement, occupation and economic status. The distribution of each variable is illustrated with tables that, for simplicity, only include ages 25, 40 and 55 and cross-sections 1993, 2003 and 2013. This simplification arises from the impossibility of publishing tables with the entire dataset. Take Table 5 on economic status. Using the whole dataset, the dimensions of the table would be 54 ages $\times$ 7 economic statuses (including totals) by 21 years $\times$ 3 genders (including totals), resulting in $23,814$ cells. Furthermore, the whole dataset is not required for illustrating the argument. Our case can be made with only two ages and two years. We chose three instead to show the sample distribution of ages that are representative of the "young", "middle-age" and "older" groups in Table 2 every decade. We use this small subsample of our data to illustrate our methods with numerical examples in the Supplementary Material. Also, we use it next to present some descriptive statistics and outline calendar time trends in the variables of our analyses.

Labor market involvement. Following Hakim (2004), we define labor market involvement using four categories: marginal (10 hours or fewer per week), half-time (from 11 to 29 hours), reduced full-time (30 to 34 hours) and full-time (35 or more hours) employment. The number of hours in paid employment includes paid and unpaid overtime in the reference week.

Table 3 shows the distribution of the people included in the small subsample of our data across degrees of labor market involvement. Fewer than one-half of all women engaged in paid employment in the 40 or 55 age groups work full-time, but approximately 80% of their male counterparts do so. Among workers 25 years old, the gender gap in full-time employment is narrower but still noticeable, ranging from 10 to 20 percentage points.

Over the 21 years considered, the most noticeable changes occur among 55-year-old women. Their rates of full-time and reduced full-time employment increase by 10 and 6 percentage points, respectively. This trend suggests that time segregation among the 55-year-olds decreases from 1993 to 2013.

[Table 3 about here.]

Occupations. We measure the classical notion of occupational segregation using the Standard Occupational Classification (SOC) produced in 1990 and updated in 2001 and 2011 for the LFS. These versions of the SOC record $77, 81$ and 90 occupational titles, respectively, at the so-called minor group level. Although the SOC changes somewhat every ten years, the classification maintains an underlying structure and coherence.

For illustrative purposes, in Table 4, we partition occupations into three basic types: male, integrated and female. (Note, however, that our analyses do not depend on this or any other partition of occupations based on the percentage of women therein.) For any given age group and year, women make up a percentage of the employed labor force. Integrated occupations are defined as those with a percentage of female workers that is ± 5 percentage points of the overall percentage of women in the labor market. Female occupations have a share of female workers that is greater than the overall percentage

plus five percentage points, while male occupations have a share of female workers that is smaller than the overall percentage minus five percentage points. Table 4 shows that integrated occupations increase over time. This trend suggests a reduction in occupational segregation.

[Table 4 about here.]

Economic status. This variable records the individual's broad relation to the labor market. People classed as inactive can be in one of the following five options: in family labor, retired, studying, permanently sick or disabled, and other. Economically active people are divided into unemployed and employed groups. Table 5 shows the distribution of people in the small subsample of our data across economic statuses. For all ages and years, there is a clear gender gap in the proportion of the population in paid work and in family labor. The gender gap in paid work is generally over 10 percentage points in favor of men. The gender gap in family labor is characterized by men's rate being at most 2%, whereas women's rate oscillates between 7% and 21%. In general, rates in paid work increase and rates in family labor decrease over the time period considered. This trend suggests a decline in economic segregation.

[Table 5 about here.]

We previously mentioned that the data for each age group are pooled across cross-sections as if they referred to the same population of a given age. However, Tables 3, 4 and 5 make plain that the British population has changed over the 21 years we study. In the Results section, we present a robustness check that evaluates the impacts of these demographic shifts on our results.

2.2 Methods

In this section, we outline the methodological framework of our analysis. The Supplementary Material contains the details and an illustration with a small subsample of our data.

2.2.1 The Mutual Information index

Assume that individuals can engage in one of U organizational units, and denote by p_u the probability that an individual is in organizational unit u, $u = 1, ..., U$. In Information Theory, $log\left(\frac{1}{p_u}\right)$ captures the amount of information, or "surprise", contained in the observation that the individual is in organizational unit u (Kullback 1959). To illustrate, consider a situation with only two organizational units, paid work and family labor. Assume that most individuals, say 90%, are in paid work. Thus, if we sampled one person and she happened to be in the labor market, we would not be very surprised. In more technical terms, the information gained would be small: $log\left(\frac{1}{0.90}\right) \approx 0.11$. If we sampled someone in family labor, a less likely event, the amount of information obtained is $log\left(\frac{1}{0.10}\right) \approx 2.3$, or $\frac{2.3}{0.11} \approx 21.9$ times larger than in the case of a person in paid work. The entropy of the distribution of p_u is the average information attained if we learn the organizational unit of a given individual, $\sum p_u log\left(\frac{1}{p_u}\right)$. In our example, the entropy would be $0.11 \times 0.90 + 2.3 \times 0.10 \approx 0.33$. As there are gender differences in the distribution of men and women over economic activities, we should expect differences in their entropies.

The M index of segregation between women and men is defined as the average increase in entropy concerning the individual's organizational unit obtained from learning her or his gender. If the distribution of women and men across organizational units were equal to the distribution of women and men in the population, there would be no gender segregation at all, and $M = 0$. In contrast, M reaches its maximum value when only one gender is present in each organizational unit and both genders are equally represented in the population.

2.3 The decomposition of market and gender segregation

We begin with the definition of the SD property. Let I be an index of gender segregation, i.e., an index that measures how differently women and men distribute over a given number U of organizational units. Consider a partition of the set of U organizational units into C clusters. Furthermore, let I_c be the index of segregation of that population across

the original organizational units U contained in cluster c. The I index of segregation is said to satisfy the SD property if, for any partition into C clusters, overall gender segregation can be expressed as the sum of two terms:

$$I = I^B + I^W, \tag{3}$$

where I^B is a *between-group* term that consists of the I index of segregation that captures the uneven distribution of women and men over the C clusters, and the term $I^W = \sum p_c I_c$ is a *within-group* term equal to the weighted average of the I_c segregation indexes of each cluster, with weights equal to their demographic shares, p_c. I^W indicates the extent to which segregation index I would decrease if there were no differences in the distribution of women and men within each of the C clusters (Mora and Ruiz-Castillo 2011).[4]

In the context of occupational segregation by gender, Mora and Ruiz-Castillo (2003) prove that, for any partition of the organizational units, the M index can be strongly decomposed. This is important because the empirical questions usually asked in decomposition analysis receive the less ambiguous answers that are possible in a segregation context when the segregation measure satisfies the SD property (Mora and Ruiz-Castillo 2011). Moreover, Frankel and Volij (2011) characterize the M index as the only index that satisfies six ordinal properties and a technical continuity property. They further revise the properties of several multigroup indices of segregation and show that the M index is the only multigroup index that satisfies SD.

Are there alternatives to the M index? In the two-group case, Theil and Finizza (1971) and Theil (1970) introduced the entropy, information or H index, a normalization in the unit interval of the M index. The H index, which is extended to the multigroup case by Reardon and Firebaugh (2002), has been used, among others, by Elliott (2005). Although the H index violates the SD property (Frankel and Volij 2011), Reardon, Yun, and Eitle (2000) establish that, for partitions of organizational units into clusters—such as those relevant in this article—the H index satisfies a weaker decomposability property,

[4] In the multigroup case, there is another strong decomposability property for partitions of the demographic groups into supergroups that should not concern us here, where we only have two demographic groups.

such that its decomposition into between- and within-group terms is free from ambiguities. However, using numerical examples and actual data, Mora and Ruiz-Castillo (2011) establish that the weights in the within-group term in the H index are not invariant to changes in the within-group distributions, a situation that leads to problems of interpretation. Therefore, when decomposability properties are desirable in empirical work, there is much to be gained by focusing—as we do—on the M index.

2.3.1 Market segregation

Traditional measures of occupational segregation are intended to capture differences in the distribution of women and men across occupations. In our approach, market segregation captures differences in the distribution of women and men across labour market categories that are characterized by an occupation *and* a certain degree of time involvement.

Let A be the number of age groups and T the number of cross-sections or periods. In our data, the individuals' age is measured in years ranging from 16 to 69, meaning that $A = 54$. In addition, the cross-sections correspond to calendar years (i.e., periods) ranging from 1993 to 2013, such that $T = 21$. For any given age a and period t, we define the index of market segregation, $MS(a,t)$, as the M index of segregation when each combination of labor market involvement and occupation is treated as an organizational unit.

Using the SD property, we can decompose $MS(a,t)$ in two alternative ways. First, we can take the time categories as clusters such that

$$MS(a,t) = TS(a,t) + O^W(a,t), \tag{4}$$

where $TS(a,t)$ measures the market segregation arising from the uneven distribution of the women and men of age a in period t across degrees of labor market involvement, and $O^W(a,t)$ is, for each age a and period t, the weighted average of occupational segregation indexes over levels of labor market involvement. Following Mora and Ruiz-Castillo (2011), the within-group term $O^W(a,t)$ can be interpreted as the part of market segregation that exists among women and men of age a in period t that is *exclusively* due to their uneven

distribution across occupations, controlling for the effect of labor market involvement.

Second, we can take the occupations as clusters such that

$$MS\left(a,t\right)=O\left(a,t\right)+TS^{W}\left(a,t\right), \tag{5}$$

where $O\left(a,t\right)$ measures the market segregation arising from the uneven distribution of the women and men of age a in period t across the occupations, that is, the usual measure of occupational segregation in the traditional literature. The within-group term $TS^{W}\left(a,t\right)$ is, for each age a and period t, the weighted average of time segregation indexes over occupations. $TS^{W}\left(a,t\right)$ is the portion of market segregation that exists among women and men of age a in period t that is exclusively due to their uneven distribution across time categories, controlling for the effect of occupations.

As mentioned previously, occupations and time can interact. The interaction $\Delta\left(a,t\right)$ is the part of $MS\left(a,t\right)$ that is simultaneously due to gender differences across degrees of labor market involvement *and* occupations:

$$\Delta\left(a,t\right)=MS\left(a,t\right)-\left[O^{W}\left(a,t\right)+TS^{W}\left(a,t\right)\right]. \tag{6}$$

Note that we cannot attribute segregation captured by the interaction term unambiguously to either time or occupation. Thus, if we compare, for example, equations (4) and (6), we obtain

$$TS\left(a,t\right)=TS^{W}\left(a,t\right)+\Delta\left(a,t\right). \tag{7}$$

That is, the term $TS\left(a,t\right)$ includes not only time segregation controlling for occupation but also the interaction term. Similarly, using equations (5) and (6), we observe that the traditional term $O\left(a,t\right)$ includes not only occupational segregation controlling for time involvement but also the interaction term:

$$OS\left(a,t\right)=O^{W}\left(a,t\right)+\Delta\left(a,t\right). \tag{8}$$

In most of this article, we express market segregation as the sum of three terms:

$$MS\left(a,t\right)=O^{W}\left(a,t\right)+TS^{W}\left(a,t\right)+\Delta\left(a,t\right). \tag{9}$$

Equation (9) is the age-period-specific version of expression (1). This approach is essentially similar to that followed in Guinea-Martin et al. (2015) to study the joint impact of gender and ethnicity on occupational segregation.[5]

2.3.2 Gender segregation

Consider the notion of gender segregation understood as the overall segregation between women and men that exists in society rather than exclusively in the marketplace. On the one hand, there are women and men who are not engaged in paid work. These people are distributed across several economic statuses. On the other hand, there are people in paid employment who are distributed across labor market categories. Consequently, women and men of age a in period t belong to organizational units defined by the combination of economic status and labor market category. Thus, we define $G\left(a,t\right)$ as the M index for age a in period t that measures gender segregation across these units. We can partition the set of these organizational units into economic statutes such that labor market categories are contained within the economic status "paid work". Because there can only logically be labor market categories within paid work, by the SD property, the only possible decomposition in this case is the following:

$$G\left(a,t\right)=ES\left(a,t\right)+p_{w}^{a,t}MS\left(a,t\right), \tag{10}$$

where $ES\left(a,t\right)$ is the economic segregation arising from the uneven distribution of women and men of age a in period t across economic statuses, $MS\left(a,t\right)$ is the market segregation arising from the uneven distribution of women and men of age a in period t across labor market categories, and $p_{w}^{a,t}$ is the proportion of individuals of age a in period t who

[5]Taking genders (or ethnic groups) as supergroups and applying the SD property for partitions of demographic groups into supergroups, Guinea-Martin et al. (2015) decompose occupational segregation measured by the M index into three terms: the effect of gender and ethnicity, controlling for the other, plus an interaction term—an analogous decomposition to the one that we introduce in equation (9).

are employed in the labor market. Equation (10) is the age-period-specific version of expression (2).

Combining equations (6) and (10) yields the decomposition of gender segregation into economic and market segregation (and of market segregation into its components) for people of age a in period t:

$$G\left(a,t\right)=ES\left(a,t\right)+p_{w}^{a,t}\times\left[TS^{W}\left(a,t\right)+O^{W}\left(a,t\right)+\Delta\left(a,t\right)\right]. \tag{11}$$

2.4 Identification of the age effect

All indexes in equation (11) are influenced by cohort and period effects. Our goal is to obtain indexes for each age net of cohort and period effects. Let $G^{W}\left(a\right)$ stand for the part of segregation that, within each age, is exclusively due to differences in the distribution of women and men across economic statuses, degrees of labor market involvement and occupations. By definition, the comparison of $G^{W}\left(a\right)$ for different values of a identifies the effect of age net of the influence of cohort and period.

Similarly, define $ES^{W}\left(a\right)$ as the part of economic segregation that, within each age, is exclusively due to differences in the distribution of women and men across economic statuses. Hence, the comparison of $ES^{W}\left(a\right)$ for different values of a identifies the evolution of economic segregation over the life course.

Consider the population engaged in paid employment, and let $MS^{W}\left(a\right)$ stand for the part of market segregation that, within each age, is *exclusively* due to differences in the distribution of women and men across degrees of labor market involvement and occupations. Hence, the comparison of $MS^{W}\left(a\right)$ for different values of a identifies the evolution of market segregation over the life course. Similarly, $O^{W}\left(a\right)$, $TS^{W}\left(a\right)$, and $\Delta\left(a\right)$ for different values of a identifies the evolution of occupational segregation controlling for time-related effects and time segregation controlling for occupation-related effects, as well as the interaction between these two variables. In the Supplementary Material, we show that by (i) multiplying both sides of equation (10) by the proportion of individuals of age a that are observed in period t and (ii) summing over all periods, we obtain a unified

framework for the study of gender, economic, market, time and occupational segregation:

$$G^W(a) = ES^W(a) + p_w^a \times MS^W(a) \tag{12}$$

$$= ES^W(a) + p_w^a \times \left[TS^W(a) + O^W(a) + \Delta(a)\right], \tag{13}$$

where p_w^a is the proportion of individuals of age a who are in paid employment, i.e., the employment rate, and the following equalities hold.

$$MS^W(a) = \sum_t p_t^{w,a} \left[O^W(a,t) + TS^W(a,t) + \Delta(a,t)\right] \tag{14}$$

$$= O^W(a) + TS^W(a) + \Delta(a). \tag{15}$$

Equation (13) highlights that economic, time, and occupational segregation are sources of gender segregation. In the Discussion section we refer to the sum of occupational segregation and the interaction term as "occupation-related segregation", $O^W(a) + \Delta(a)$. Similarly, in the Results and Discussion sections we find it convenient to refer to the sum of time segregation and the interaction term as "time-related segregation", which we denote by $TS(a) = TS^W(a) + \Delta(a)$. In this simplification, there are three sources of gender segregation: economic, occupational and time-related segregation, i.e., $ES^W(a)$, $O^W(a)$ and $TS(a)$, respectively. Taking into account that

$$G^W(a) = ES^W(a) + p_a^w O^W(a) + p_a^w TS(a), \tag{16}$$

we can interpret $ES^W(a)$ as both a source of segregation and a contribution to overall gender segregation. In contrast, we say that the contributions of occupational and time-related segregation to overall gender segregation are $p_a^w O^w(a)$ and $p_a^w TS(a)$, respectively.

Finally, to quantify the relative role of occupations in gender segregation, consider the possibility that occupations on their own generate zero segregation, i.e., $O^W(a) = 0$ for all a. In this case, gender segregation becomes

$$G'(a) = ES^W(a) + p_w^a TS(a). \tag{17}$$

In words, in the absence of occupational segregation, gender segregation is equal to the sum of economic segregation and the contribution of time-related segregation. We refer to $G'(a)$ as "non-occupational segregation" and to the sources of economic and time-related segregation, $ES^W(a)$ and $TS(a)$, as "non-occupational sources of segregation".

3 Results

The estimates for all segregation indexes and the overall employment rate over the life course, from age 16 to age 69, are provided in Table 10 in Appendix D of the supplementary material. We organize the presentation of this wealth of information into five subsections. First, we provide a bird's eye view of the findings with the help of Figures 1, 2 and 3. Second, we divide the presentation of the evolution of segregation over the life course into four stages. For each stage, we present two types of information: (i) the distribution by gender across categories of economic status, degrees of labor market involvement and sex-typed occupational groups and (ii) the overall employment rate and the index values for all types of segregation. Third, we quantify the relative role of occupations in gender segregation. Fourth, we assess the influence on our findings of the employment rate. Fifth, we conduct one robustness check.

3.1 A bird's eye view

Figures 1, 2 and 3 provide a bird's eye view of segregation trends across the life course in the UK over the period from 1993 to 2013. In contrast with the more common approach that pays attention to occupational segregation only, these figures make plain that these notions of segregation cannot be properly addressed in isolation because women and men are simultaneously segregated on various counts throughout the life course.

Figure 1 shows the evolution of market segregation, $MS^W(a)$, over the life course and that of its components: occupational segregation, time segregation and their interaction

(see equation (15)). The following three results stand out: (1) market segregation increases over the life course, with especially pronounced rises early and later in life; (2) occupational segregation is the major contributor to market segregation; and (3) in the early and later part of the life course, the magnitude of the interaction between time and occupations is noticeable and negative.

[Figure 1 about here.]

Figure 2a graphs the results of applying equation (12) to our data. It reveals three main findings. First, the marketplace is the major contributor to gender segregation. Second, the evolution of gender segregation is heavily influenced by the employment rate that exhibits a spectacular rise and fall in the early and later years, respectively, and is relatively stable at approximately 80% during the core working years, that is, from their early twenties to their late forties (see Figure 2b). The upswing in gender segregation until the thirties and its plunge after the fifties coincide, for the most part, with the rise and fall of the employment rate. Third, there are two peaks in economic segregation: one is concurrent with the career- and family-building years and the other with the retirement phase of the life course.

[Figure 2 about here.]

Figure 3 illustrates the evolution over the life course of the three sources of gender segregation in equation (16), i.e., $ES^W(a)$, $O^W(a)$, and $TS(a)$. An important result stands out: occupational segregation and the non-occupational sources of segregation follow opposite trends during the core working years (ages 22 to 49) and after age 65. While occupational segregation weakens throughout most of the twenties and early thirties, women and men deepen their divisions in participation and degree of time involvement in the market. Thereafter, occupational segregation turns upwards and economic and time-related segregation soften, at least until people's 50s.

During the core working years, gender differences in family labor and part-time paid work draw "the time divide", in Jacobs and Gerson's (2004) words, between women and men in society. They are the main non-occupational sources of segregation. Take the life

span from ages 22 to 49. Then, the correlation coefficient between the rate of women in family labor and the economic segregation index is 0.95. Similarly, the correlation coefficient between women's rate in part-time work and time segregation in the marketplace is 0.69.

[Figure 3 about here.]

The opposite trends between occupational segregation and economic and time segregation reveal that there are at least two types of women.[6] One type of woman leaves paid employment, thereby contributing to the rise in economic segregation. A second type of woman remains employed—in either full- or part-time work—in occupations more similar to men's. Hence, they help to decrease segregation in occupations. Now, if the first type of woman moves from full-time employment to no participation in the labor market, the women who remain in the labor market will exhibit starker differences with men in time requirements, thereby increasing time segregation.

In summary, Figure 3 brings to the fore one finding of our unified framework: occupational segregation, on the one hand, and the sources behind the time divide (economic and time-related segregation), on the other, evolve in close connection with one another. In view of the patterns of their joint evolution, we distinguish four stages in segregation over the life course: coming of age (16-21), career building and family formation (22-35), the return to segregating occupations (36-49) and growing older (50-69).

3.2 The evolution of segregation over the life course

3.2.1 Coming of age

At age 16, women and men have yet to diverge, and all forms of segregation are at their lowest levels. Economic segregation stands at 0.4 index value points, reflecting that the majority of this age group is still studying (see Table 6). Among the minority in paid

[6]There is a growing empirical literature on the heterogeneity in women's labor market behavior. See, for example, Evertsson, England, Mooi-Reci, Hermsen, de Bruijn, and Cotter (2009) and Esping-Andersen (2009).

employment, most work only marginal hours or half time. Hence, their time segregation is also at its minimum value at 4.9 points.

The appreciable negative interaction term in Figure 1 (-3.4 index value points at age 16) reflects the "crossing" of the two factors that characterize the typical jobs of women (men): belonging to a female (male) occupation and being part time (full time). For example, at this age, among women, the ten most common jobs include one that is full time and female and two that are part time and male, while among men, seven of the ten most common jobs are part time and male. The segregating power of this "unnatural" combination of features cannot be unambiguously attributed to either occupation or time alone.

Occupational segregation is also at its lowest mark in the life course (21.3 points) because a large proportion of women and men work in the same and small subsample of occupations. For example, from 2001 to 2010, the longest period with a single occupational classification, 67.6% of women and 43.9% of men work as *sales assistants and retail cashiers* or in *elementary personal services occupations*.[7]

[Table 6 about here.]

Only five years later, at age 21, many women and men have already sorted themselves into diverging paths. Thus, although approximately one-fifth of the population remains enrolled in full-time education, economic segregation increases to 4 points. To a large extent, this figure reflects a gender discrepancy in the labor market activity rate—$(62.5 + 13.6) - (56.9 + 8.0) = 11.2$ percentage points in favor of men—and in the rate of family labor—11 percentage points in favor of women.

In the marketplace, the gender gap in the rates of half-time and full-time employment widens, boosting the time segregation index to 6.2 points. Still, compared with other phases of the life course, the rate of 21-year-old women in full-time paid employment is relatively high (53.8%) and strengthens the negative interaction term (-5.1 points). For example, seven of the ten most common jobs among the women in this age group are full

[7] To simplify this and all the following illustrations and examples of the most common jobs, we use the 2001–2010 period and collapse the four degrees of labor market involvement into a full-time vs. part-time work dichotomy around a threshold of 35 hours per week.

time and female. For their part, men of the same age have three jobs that are full time and female among their ten most common jobs.

In addition, people still cluster into the same two occupational groups that they did at age 16 but less intensely: "only" 29% of women and 19.9% of men do. Nevertheless, at 21, the occupational segregation index value soars to a local maximum of 27.8 points.

Together with the period between the ages 60 to 64, this is the only stage in which occupational and non-occupational segregating forces push in the same direction and together boost gender segregation. In total, these changes over the first six years of the life course increase gender segregation from its minimum value of 6.2 at age 16 to 21.3 points by 21. This 15 point difference represents the greatest expansion of gender segregation over the whole life course.

3.2.2 Career building and family formation

The ages from 22 to 49 are, for men, the core years of working in the marketplace and, for women, the core years of working in the marketplace, at home, or both. Figures 1, 2 and 3 show that these nearly three decades in people's lives can be divided into two stages. The first stage, from ages 22 to 35, is organized around the average age at childbearing—28.9 in 2004 in England and Wales (Ní Bhrolcháin and Beaujouan 2012)—and therefore includes the prime childbearing years (Hodson and Sullivan 2008). These years are also central in promoting one's position in the labor market. Correspondingly, we follow Moen and Sweet (2004) in referring to the years from 22 to 35 as the "career-building and family-formation years."

In young adulthood, increasing numbers of women and men diverge in the time apportioned to family and wage labor. Soon after people finish their schooling, men's employment rate surges, while women's also expands, albeit less so because their rate of family labor simultaneously increases. Women's rate of family labor peaks at 20% when they are 30 years old. It remains at this level until after age 35, when it commences its descent (see Table 7). On the contrary, men's rate of family labor hovers at approximately 1%. Together with the gender gap in the employment rate, this is the major reason that

the economic segregation of women and men is at its working years maximum of approximately 6 index value points for a whole decade, from the mid-twenties to the mid-thirties (see Figure 4).

[Table 7 about here.]

Furthermore, from the ages of 21 to 35, market segregation increases from 28.9 to 34.1 points, propelled by time segregation and the interaction term. The former grows from 6.2 to 9.9 points and the latter from −5.1 to 1.4. The common trend underlying these changes is the channelling of women's employment toward part-time jobs. The interaction's upward direction corroborates Gregory and Connolly's finding that in the UK, "the peak age range for women switching from full to part-time work is 27–34" (Gregory and Connolly 2008, p. F3). By age 35, two-fifths of women in the labor market work half time, while most men cling to full-time jobs. In this setup, the pattern responsible for the earlier negative interaction term—women's tendency to work full time in female occupations—no longer holds.[8]

Occupational segregation evolves in stark contrast with the expansion of the time divide within and beyond the market. It decreases from 27.8 points at age 21 to 22.9 at age 35. This indicates that, controlling for time, the women who remain in paid work during these critical years are able to build careers that approach those of men. Notably, women who remain employed at this age are less concentrated in a few occupations than at other times. "Only" 6% of 35-year-old women in paid employment work as *teaching professionals* and another 6% as *sales assistants and retail cashiers*, their two most common occupations at that age. In addition, the remaining women in paid work are distributed more evenly across occupational classifications than at other life stages, as evidenced by the 18% share of women who work in male occupations at age 35, whereas this share is only 10% at age 21.[9]

[8]Gregory and Connolly (2008, p. F3) further note that the number of UK women in part-time employment is at its highest when they are 35 to 45 year old, "the peak years for childcare".

[9]The selectivity of women of childbearing age who remain in paid employment is borne out by previous findings in the literature. Using retrospective longitudinal data, Jacobs (1995) concludes that during the 1946–1986 period, British women with continuous careers were less concentrated in feminized occupations ten to sixteen years after they joined the labor market than women with discontinuous careers.

In spite of the reduction in occupational segregation, economic and time-related segregation expand and take gender segregation to its highest level in the life course at approximately age 35. Figures 2 and 3 show that during this stage of the life course, gender segregation climbs to the top of the inverted U: it intensifies by 11.3 index value points from 21.3 at age 21 to 32.6 by age 35. Additionally, the employment rate continues to increase, gaining 19 points from ages 21 to 30 and fuctuating thereafter around the 80% mark.

3.2.3 Return to segregating occupations

The second period of the core working years follows the nearly horizontal line at the top of the inverted U-shaped pattern of gender segregation in Figure 2a. We define its starting point at age 36 when reversals in the trends of occupational segregation and the time divide begin and then persist until age 49 when people start retiring from paid work in increasing numbers.

Just before this period begins, economic segregation stands at 5.6 points at age 35 and decreases monotonically to 2.2 at age 49. This equalization in the economic statuses of women and men is brought about by two interrelated trends: (a) the percentage of women in paid work increases, which narrows the employment gap to only 9 percentage points in favor of men at age 49; (b) women's rate of family labor decreases to only 8% (also at age 49). Similarly, time segregation in the market weakens from 9.9 to 7.6 points, and the interaction term decreases from 1.4 to 0.8 points (see Figure 1).

The subsiding of the time divide would soften gender segregation if occupational segregation remained at the low levels reached by age 35. However, occupational segregation rebounds from a value of 22.9 at age 35 to 27.9 points by age 49 and props up gender segregation on its plateau. The opposing trends of occupational and non-occupational segregation suggest that when children are of school age, which begins at 5 years of age in the UK, women who were in part-time paid work or in family labor increase their

Furthermore, using data from the Luxembourg Income Study for the mid-1990s, Pettit and Hook (2009, Tables 5.1 and 5.2) note that British women with a child under six who remained in paid work were more similar—in terms of their occupational profiles—to men than to the women who quit their paid jobs.

hours of involvement in the marketplace. As a result, the over-representation of women in a few occupations starts intensifying. For example, 8% of 49-year-old women in paid employment work as *teaching professionals* and 7% in *secretarial and related occupations*. Overall, 76% of them work in female occupations.

3.2.4 Growing older: the midcourse years

Age 50 marks the start of the stage in the life course that Phyllis Moen (2003) has called "late midlife" or "the midcourse years" in her analyses of US data. This label can be applied to other Western countries where, as Moen argues, it is reasonable to distinguish the process of growing older from the fragility associated with being old. The midcourse years are characterized by gender differences in the retirement age, the emergence of ill health as a pathway to retirement and the combination of retirement and paid employment through a reduction of work hours (see Figure 4).

Three parts make up this stage. The first part, from ages 50 to 59, initiates a substantial rise in the rates of retirement, sickness and disability together with a fall in the employment rate. Nevertheless, in these ten years, occupational segregation continues its upward trend while economic and time-related segregation remain stable. Ages 60 and 65 bound the second period in the midcourse years. These are the traditional state pension ages for women and men in the UK, respectively.[10] Their gap brings about an upsurge in all the sources of segregation—economic, time-related, and occupational. The third and final part of the midcourse years runs from ages 66 to 69. Then, again, occupational and non-occupational segregating forces are at loggerheads.

[Figure 4 about here.]

Consider the evolution of the retirement rate. Until the early fifties, retirement is negligible, but by age 60, over one-third of women are retired while only 12.4% of men are, i.e., there is a gender gap of 23 percentage points in favor of women (see Table 8). By age 65, more women and men have retired, but the gap remains steady at 23 percentage

[10]This was the case until May 2010. Since April 2010, the UK State Pension ages of women and men have increased gradually, with the objective of reaching a common age, 68, by the year 2046.

points. By age 69, the majority of women and men are retirees, and the gap narrows to 14 percentage points. In short, women quit paid work at a younger age than men. This is because in heterosexual couples, there typically is an age gap of two to three years between an older man and a younger woman (Blundell, Meghir, and Smith 2002; Ní Bhrolcháin 2005) and partners tend to exit wage labor synchronously (Moen, Huang, Plassmann, and Dentinger 2006). This general tendency is reinforced in the UK by the abovementioned gender gap in the statutory retirement age for collecting social security benefits.

For their part, sick rates are quite gender neutral until age 59. Up to that point, there is usually only a one-percentage-point gap or less in favor of women. The percentage of 59-year-old women who are permanently sick is 16%. This percentage drops to 11% when they are 60. As a result, the gender gap in sick rates increases to 6 percentage points in favor of men. Similarly, a full 22% of men are classed as permanently sick at age 64 but only 12% are one year later.[11] These patterns suggest that sickness and disability are pathways to early retirement thanks to the pecuniary benefits that this economic status often entails (Dahl, Nilsen, and Vaage 2003; Gruber and Wise 2004). However, many workers stop being classed as permanently sick and likely become "the retired" when they reach state pension age and enter their pension scheme.

[Table 8 about here.]

Taken together, shifts in employment, retirement and sickness rates increase economic segregation in the 60 to 65 age range (see Figure 2) and provide the backdrop for the drastic variation in market segregation and its components illustrated by Figure 1. Two phenomena occur hand in hand: (a) the diminishing population that remains engaged in paid work and (b) the concentration of this population in part-time employment and in a few occupations. Time segregation increases from 9.8 index value points at age 59 to 11.3 points by age 69 (see Table 8). Behind such growth is the channelling of fewer and fewer workers toward fewer and fewer hours of paid employment. For example, approximately two-fifths of the few men working at age 69 are employed half time. In addition, from 59

[11] For brevity, age 64 is not included in Table 8, but an expanded Table is available upon request.

to 69, the percentage of women working marginal hours more than triples—from 12.1 to 41.5 percentage points—while for men there is a sevenfold increase—from 3.7% to 25.1%.

Men's reduced hours in the market create numerous examples of "contradiction" in the typical features of their employment. For example, five of their ten most common jobs at age 69 are part-time and male. Men's reduced hours in male occupations are responsible for the downward trend in the interaction term from −1.6 points at age 59 to −7.3 points at age 69.

With regard to occupations, at age 59, 18% of women work in either *secretarial and related occupations* or as *sales assistants and retail cashiers*. However, by age 69, 27% of the few women who remain in paid employment work in either *elementary cleaning occupations* or as *sales assistants and retail cashiers*. On the contrary, 15% of men work as either *transport drivers and operatives* or in *construction trades* at age 59. By age 69, their concentration within a few occupations also increases, although less so: 17.1% of these men work as either *transport drivers and operatives* or in *agricultural trades*. The clustering of women and men around distinct occupations by the end of their working lives pushes occupational segregation to its highest value (46.8 points) at age 69 (versus, for example, 32 points at age 59 and 27.8 points at age 21).[12]

Despite (a) the increase in economic segregation and (b) the change in the makeup of market segregation brought about by reduced work hours and clustering around a few occupations among older workers, Figure 2b evinces that the employment rate is the driving force of the decrease in gender segregation after the state pension age. Before that age, gender segregation diminishes moderately from, for example, 31.7 index value points at age 49 to 27.5 at age 59. The employment rate reaches its minimum value of 10% at age 69, curtailing gender segregation severely to 9.2 points. The magnitude of this figure is similar at the start of the life course: 6.2 points at age 16, when only 25.2% of the population is engaged in paid work.

[12]On occupational segregation at older ages in the UK, see also Lain (2012).

3.3 Gender segregation beyond occupation

Figure 5 graphs gender segregation as expressed in equations (13) and (17)—that is, $G^W(a)$ and $G'(a)$. These terms stand for gender segregation with occupations included and gender segregation excluding the segregating force that is exclusively attributable to occupations, respectively. We call the latter "non-occupational segregation".

[Figure 5 about here.]

To be precise, gender segregation is approximately twice as large as occupational segregation at some points of the career- and family-building stage of the life course, as well as during the retirement stage. Consider age 35 in Table 7. The employment rate stands at 79.4%. Thus, occupational segregation contributes $p_w^a O^W(a) = 0.794 \times 22.9 = 18.2$ of the 32.6 points of gender segregation, $G^W(a)$. In other words, in a hypothetical situation where occupations are completely integrated, 44.4% of gender segregation (14.5 points) would remain at this age due to the contributions of economic and time-related segregation—which amount to 17.1% and 27.3% of overall gender segregation, respectively (see Table 9).

Considering these calculations for every single age, we conclude that gender segregation is consistently 20% above occupational segregation after people pass their teens. Table 9 presents this information for selected ages. (A table for all ages is available upon request.) The main results are three. (1) Gender segregation generated by non-occupational forces increases from one-fifth to one-forth, one-third and just under one-half of all segregation in the early twenties, mid-twenties, late twenties and mid-thirties, respectively. (2) In people's forties, non-occupational segregation recedes to approximately one-third of all segregation. (3) However, it returns with force in people's sixties, when it reaches two-fifths (age 60) and approximately one-half (from age 63 onwards) of the little overall segregation that remains.

[Table 9 about here.]

3.4 The influence of the employment rate

The evolution over the life course of gender segregation (Figure 2a) closely resembles the progression of the employment rate (Figure 2b): it surges in the late teens and early twenties; it stabilizes during the prime labor market involvement years when approximately 80% of people are engaged in paid employment; and finally, it plunges after age 50. In short, in the UK, much of the evolution of segregation reflects the proportion of people in paid employment.

[Figure 6 about here.]

Do our economic and time segregation results hold in the face of the central role played the employment rate? To answer this question, we consider equation (12) with one modification: the term for market segregation, $MS^W(a)$, is weighted by $\bar{p}_w = 0.672$, the average proportion of individuals aged 16 to 69 that are engaged in paid employment over the 1993–2013 period. The results are graphed in Figure 6. They show that, holding the employment rate constant, (a) economic segregation in the 20s, 30s, and early 60s is non-negligible, and (b) time-related segregation widens the gap between gender segregation and occupational segregation in the 30s, 40s, and 50s. In short, our main results are not unduly influenced by the shifting employment rate.

3.5 Robustness check

To address potential confounding of age, cohort and period effects, we have proposed a method based on the SD property of the M index. We thus make cohort and period coterminous and identify segregation at each age. This method assumes that the segregation patterns over the life course that we identify are stable in the sample. However, the distributions of women and men across economic statuses, degrees of labor market involvement and occupations vary to a certain extent over the 21 years spanned by the data. For this reason, we have conducted a robustness check on our findings (see Appendix **??** of the Supplementary Material), concluding that the main results hold for two

five-year-long periods during which the assumption of stability in the segregation profile by age of the population seems acceptable.

4 Discussion

In this article, we study British society from 1993 to 2013. We find that gender segregation follows an inverted U-shaped pattern over the ages from 16 to 69. The methodological linchpin of the framework is the SD property of the M index, which we repeatedly apply to empirically measure the components of segregation for each age net of cohort and period effects. Next, we group our findings in terms of four consequences they have for the existing literature on gender segregation.

Consequence 1. On the traditional measure of occupational segregation. The traditional approach to measuring occupational segregation would lead to what we call "occupation-related segregation", i.e., the sum of the segregation that is unambiguously attributable to gender differences in occupations, $O^W(a)$, plus the interaction term, $\Delta(a)$, in equation (15). Failure to isolate $O^W(a)$ leads to overlooking aspects of interest to gender relations. For example, during the career-building and family-formation years, $O^W(a)$ and $\Delta(a)$ follow opposite trends that cancel each other out. Hence, if we only measured occupation-related segregation, we would miss that in this life stage, controlling for time segregation, occupational segregation weakens. Moreover, after age 35, occupational segregation expands by less than what occupation-related segregation would suggest. This is because the entry of many women into female and part-time jobs turns the interaction term positive.

Consequence 2. On the tradeoff between time-related and occupational segregation. In line with many other scholars, we recognize that gender differences in hours of work impact occupational segregation. Pettit and Hook (2009) describe this in terms of a tradeoff between part-time work and occupational segregation: institutional arrangements that encourage women's employment in part-time jobs also result in high

levels of occupational segregation.

To address this question, we define market segregation as the sum of occupational and time-related segregation. Unsurprisingly, we find that part-time employment contributes to market segregation. However, our unified framework brings to the fore that the gendered tradeoff between time-related and occupational segregation manifests in three distinct phases throughout the life course. This is the second consequence of our findings.

The first phase includes the prime childbearing years. Then, women's rising rates of part-time work fuel time-related segregation. Simultaneously, women and men on each side of the time divide become more similar in their occupational allocation, leading to the reduction in occupational segregation discussed in Consequence 1. The second phase starts when many children are of school age. Then, women augment their hours in paid work and drive time-related segregation down. Simultaneously, they cluster in a narrow set of occupations and drive occupational segregation up. Finally, and somewhat differently, the post-retirement years define the third phase. Then, few women and men remain in paid work and they typically work only marginal hours in heavily gender-typical occupations. Therefore, time-related segregation ebbs but occupational segregation surges to unprecedented levels.

Consequence 3. On segregation beyond the marketplace. As Cohen (2004) notes, the literature is divided between housework and occupational segregation. We agree with him that this state of affairs precludes considering the relationship between family and market labor. The divergence between overall gender segregation and the segregation that stems from occupations alone supports a holistic approach à la Cohen. Had we concentrated exclusively on the marketplace, we would have concluded that gender segregation grows monotonically (see Figure 1).

Our unified framework for the measurement of segregation across the board introduces two novelties. The first consists of estimating the economic segregation of women and men over six economic statuses. Thanks to this approach, we complete the picture of the "gendered tradeoff". The conclusion is that the ebb and fow of economic and occupational

segregation mirrors that between the latter and time-related segregation described in Consequence 2.

The second novelty relates to the role that the employment rate plays in the measurement of segregation. Summing economic and market segregation requires that the latter be weighted by the proportion of people in paid work. This fact makes the evolution of gender segregation resemble the inverted U shape of the employment rate that its market component transmits (see Figure 2).

Consequence 4. On the life course perspective and the heterogeneity of women. Our measurement framework yields a dynamic description of the gendered life course. Economic and time segregation become critical around the years devoted to career and family building. However, their infuence lingers until gender disparities in the retirement age and in the incidence of permanent sickness take a central role in the little gender segregation that remains at older ages. Occupational segregation, which is the dominant segregating force throughout the life course, is subject to a tradeoff with the other segregation sources.

The multiple sources of segregation are interconnected synchronously and diachronically. This is because key events in the life and work domains take place simultaneously and are age graded (Brückner and Mayer 2005). Ultimately, time is yet another scarce resource in the gender system (Ridgeway 2014). You either accumulate "work time" and partake in "promotion rituals" (Ridgeway 2014) when the time comes or you do not (Scott 2008). You either become involved in intensive parenting when your children are young or you do not (Cha 2013; Stone 2008). You either retire from paid work together with your partner or you do not (Radl 2012). Career and family building (Moen and Sweet 2004) exemplify activities that occur at around the same life stage in gendered, separate and often "greedy" and competing realms of life (Blair-Loy 2003; Cha 2013). Allegiance to one dimension entails a lesser degree of adherence to, or even complete oblivion for, other spheres.

Segregation occurs because women and men specialize differently. Our results highlight that the evolution of segregation stems from the heterogenous timings of activities

in the lifespan. This heterogeneity mostly pertains to women. For most men, during most of their lives, there is only one road they are walking: that of full-time employment. In contrast, different women combine labor alternatives in distinct ways. Women's heterogeneity to a large extent drives the dynamic patterns in segregation.

5 Further research

We can think of several avenues for future work. First, Charles and Grusky (2004) argue that a sizable part of the segregation of women and men in the market can be traced to their differential distributions across manual and non-manual jobs. With the M index, it is easy to incorporate this and other features of jobs or workers into the research design. In preliminary and unpublished analyses, we found that the manual vs. non-manual distinction is of less importance to gender segregation than is the time divide. Thus, in this article, we have focused on the latter. However, there may be periods (countries) when (where) the manual divide drives the segregative process in the market.

Second, our data record distinctions in neither levels and fields of study nor in household chores. At younger ages, most segregation is fed by differences in levels and fields of education (Charles and Bradley 2009). When segregation among young students is mapped, it will match, to a lesser or greater degree, the level of the ensuing economic and market segregation in later stages of the life course. Similarly, gender segregation in old age is presumably fed mostly by the gendered division of household chores. Time use data may help discern whether the "one and a half" breadwinner model turns into "one and a half pensioner", or less (Sainsbury 1996), later in the life course, as the current literature on aging suggests (Ginn, Street, and Arber 2001; Esping-Andersen 2009; Meyer and Herd 2007). In conclusion, future research that incorporates more segregating forces at younger and older ages may hoist the tails of the inverted U and draw a new picture with a fatter pattern.

Third, since the late 1960s, many studies make inter-temporal comparisons of the level of occupational segregation (see, for example, Gross 1968 and Blau, Brummund, and

Liu 2013). Our methodological approach can make two contributions to this literature. First, it can account for sources of variations in segregation over calendar time other than occupation. Second, it can solve the following difficulty: direct measures of segregation for a given period (typically one calendar year) confound the effects of period, age and cohort. The SD property satisfied by the M index allows the researcher to isolate the measure of segregation by period net of the infuence of age and cohort in an analogous way to the identification of the effect of age net of cohort and period that we have presented in this article.

Fourth, many researches have performed international comparisons of occupational segregation to highlight the role of institutional and social arrangements (see, for example, Cooke 2011, Fagan and Rubery 1995, Pettit and Hook 2009 and Roos 1985). Our methodological approach can make three contributions to this literature. First, it can again broaden the view to encompass non-occupational sources of segregation. For the second contribution, consider a country A where women and men work full time and a country B where only men work in the labor market. By construction, the employment rate is lower in country B and weights down its level of market segregation relative to country A. Conversely, economic segregation in B is greater than in A. How would these two opposing factors affect the comparison of gender segregation between the two countries? For the third contribution, consider now a country B where women work part time and men full time. By construction, both country A and country B have the same economic segregation. Given the prevalence of women in part-time jobs, would country B exhibit greater overall gender segregation than country A? Alternatively, is there a tradeoff between time and occupational segregation?

Finally, our results suggest that the evolution of segregation over the life course is driven by the asymmetry between (a) the large homogeneity and constancy in men's state of full-time employment—regardless of family-formation pressures—and, in stark contrast, (b) the heterogeneous responses that at least two types of women have to the pressures and quandaries posed by major life and work events. Is a binary characterization a good approximation of women's plurality?

Appendices

In this supplement we first include in Appendix A all technical details and mathematical notation required in our framework. Next, in Appendix B we illustrate our methods with a small subsample of our data. In Appendix C we conduct one robustness check. Finally, Appendix D contains Table 10 with all the indexes and overall employment rates graphed in the Figures of the main article.

Appendix A Methods

Let $P = \{p_q\}$ denote the probability distribution of random variable X. The entropy of distribution P is the expected value of the information attained with the variable X: $\mathrm{E}(P) = \sum p_q \log\left(\frac{1}{p_q}\right)$, where *log* is, without loss of generality, the natural logarithm.

Let $P^{\mathcal{U}}$ represent the distribution of individuals across organizational units $u \in \{1 \dots U\}$; let $P^{\mathcal{U}|g}$ represent the distribution across organizational units for individuals of gender $g \in \{\text{woman}, \text{man}\}$. The M index of segregation between women and men is

$$M = \sum_g p_g \left[\mathrm{E}\left(P^{\mathcal{U}}\right) - \mathrm{E}\left(P^{\mathcal{U}|g}\right)\right], \tag{18}$$

where p_g is the proportion of people of gender g.

Decomposition of market segregation

Women and men work jobs characterized by an occupation $j = 1, \dots, J$ and a certain degree of time involvement $l = 1 \dots L$. Let A be the number of age groups and T the number of cross-sections or periods. For any given age a and period t, we define the index of market segregation

$$MS(a,t) = \sum_g p_g^{w,a,t} \left[\mathrm{E}\left(P^{\mathcal{L}\times\mathcal{J}}(a,t)\right) - \mathrm{E}\left(P^{\mathcal{L}\times\mathcal{J}|g}(a,t)\right)\right], \tag{19}$$

where $p_g^{w,a,t}$ is the proportion of employed people of gender g given age a and in period

t, $P^{\mathcal{L}\times\mathcal{J}}(a,t)$ represents the distribution of individuals across jobs for age a and period t, and $P^{\mathcal{L}\times\mathcal{J}|g}(a,t)$ represents the distribution across jobs for individuals of gender g for age a and period t.

By the SD property of the M index, we obtain equation (4)

$$MS(a,t) = TS(a,t) + O^W(a,t),$$

where

$$TS(a,t) = \sum_g p_g^{w,a,t}(a,t)\left[\mathrm{E}\left(P^{\mathcal{L}}(a,t)\right) - \mathrm{E}\left(P^{\mathcal{L}|g}(a,t)\right)\right], \tag{20}$$

and $O^W(a,t) = \sum_l^L p_l^{w,a,t} \times O(a,t,l)$ is the within-group index of gender segregation equal to the weighted average of $O(a,t,l)$ terms. Each $O(a,t,l)$ term measures the segregation in period t across the J occupations for women and men of age a and with labor market involvement l. Moreover, $p_l^{w,a,t}$ is the proportion of employed people aged a in period t that has a degree of labor market involvement l.

Similarly, by the SD property of the M index, we obtain equation (5)

$$MS(a,t) = O(a,t) + TS^W(a,t),$$

where

$$O(a,t) = \sum_g p_g^{w,a,t}(a,t)\left[\mathrm{E}\left(P^{\mathcal{J}}(a,t)\right) - \mathrm{E}\left(P^{\mathcal{J}|g}(a,t)\right)\right], \tag{21}$$

and $TS^W(a,t) = \sum_j^J p_j^{w,a,t} \times TS(a,t,j)$. Each $TS(a,t,j)$ term measures the segregation in period t across the L time requirements for women and men of age a and occupation j, and $p_j^{w,a,t}$ is the proportion of employed people aged a in period t that has occupation j.

The interaction $\Delta(a,t)$ is the part of $MS(a,t)$ that is simultaneously due to gender differences across degrees of labor market involvement *and* occupations. Hence, equation (9):

$$MS\left(a,t\right)=O^{W}\left(a,t\right)+TS^{W}\left(a,t\right)+\Delta\left(a,t\right).$$

Gender segregation

Women and men are distributed across K economic statuses and those in paid employment are distributed across $L\times J$ jobs. Consequently, women and men of age a in period t belong to one of the $K+L\times J$ organizational units defined by the combination of economic status and labor market category. Thus, we define $G\left(a,t\right)$ as the M index for age a in period t that measures gender segregation across $U=K+L\times J$ units:

$$G\left(a,t\right)=\sum_{g}p_{g}\left(a,t\right)\left[\mathrm{E}\left(P^{\mathcal{K}+\mathcal{L}\times\mathcal{J}}\left(a,t\right)\right)-\mathrm{E}\left(P^{\mathcal{K}+\mathcal{L}\times\mathcal{J}|g}\left(a,t\right)\right)\right], \tag{22}$$

where $p_{g}\left(a,t\right)$ is the proportion of people of gender g given age a and period t, $P^{\mathcal{K}+\mathcal{L}\times\mathcal{J}}\left(a,t\right)$ represents the distribution of individuals across the combination of economic statuses and labor market categories for age a and period t, and $P^{\mathcal{K}+\mathcal{L}\times\mathcal{J}|g}\left(a,t\right)$ represents the same distribution for individuals of gender g. By the SD property, we obtain equation (10)

$$G\left(a,t\right)=ES\left(a,t\right)+p_{w}^{a,t}MS\left(a,t\right),$$

where

$$ES\left(a,t\right)=\sum_{g}p_{g}^{a,t}\left(a,t\right)\left[\mathrm{E}\left(P^{\mathcal{K}}\left(a,t\right)\right)-\mathrm{E}\left(P^{\mathcal{K}|g}\left(a,t\right)\right)\right], \tag{23}$$

where $p_{g}^{a,t}$ is the proportion of people of gender g given age a and period t, $P^{\mathcal{K}}\left(a,t\right)$ represents the distribution of individuals across economic statuses for age a and period t, and $P^{\mathcal{K}|g}\left(a,t\right)$ represents the distribution across economic statuses for individuals of gender g for age a and period t.

Identification of the age effect

Define now the entire space of organizational units as $U = A \times T \times [K + (L \times J)]$, which contains all the possible combinations of age, year, economic status, degree of labor market involvement and occupation.

In this scenario, we are interested in the partition of U into A superunits indexed by $U(a)$, i.e., $U \equiv \bigcup_a U(a)$, where $U(a) = T \times [K + (L \times J)]$. For each a, let $G(a)$ be the M index of *gender-cum-year segregation* measuring the gender segregation of all individuals of age a over $T \times [K + (L \times J)]$ organizational units. Then, each $U(a)$ can be partitioned into T superunits containing $[K + (L \times J)]$ organizational units. By the SD property,

$$G(a) = Y^B(a) + G^W(a), \tag{24}$$

where $Y^B(a)$ is the between-group index of gender segregation measuring how unevenly women and men are distributed over the T years in the dataset, and $G^W(a) = \sum_t p_t^a G(a,t)$, where p_t^a is the proportion of individuals of age a that are observed in period t.

Similarly,

$$ES(a) = Y^B(a) + ES^W(a), \tag{25}$$

where $ES^W(a) = \sum_t p_t^a ES(a,t)$, and

$$MS(a) = Y_w^B(a) + MS^W(a), \tag{26}$$

where $Y_w^B(a)$ is the between-group index of gender segregation measuring how unevenly the women and men in paid employment are distributed over the T periods in the dataset, and $MS^W(a) = \sum_t p_t^{w,a} MS(a,t)$, where $p_t^{w,a}$ is the proportion of employed people of age a in paid employment and observed in period t.

If we multiply both sides of equation (9) by $p_t^{w,a}$ and sum over all values of t, we obtain equation (15) where

$$O^W(a) = \sum_t p_t^{w,a} O^W(a,t),$$

$$TS^W(a) = \sum_t p_t^{w,a} TS^W(a,t),$$

$$\Delta(a) = \sum_t p_t^{w,a} \Delta(a,t).$$

Similarly, if we multiply both sides of equation (10) by p_t^a and sum over all values of t we obtain

$$G^W(a) = ES^W(a) + \sum_{t=1}^{21} \left(p_t^a \times p_w^{a,t} \times MS^W(a,t) \right). \tag{27}$$

Given that $p_t^a \times p_w^{a,t} = p_w^a \times p_t^{w,a}$, where p_w^a is the proportion of individuals of age a who are in paid employment, we obtain a unified framework for the study of gender, economic, market, time and occupational segregation, as expressed in equations (12) and (13) of the main manuscript.

Appendix B An illustration of methods with a small subsample of our data

In Appendix B we apply the steps explained in the Methods section of the main article and in Appendix A of the supplementary material to the data in Tables 3, 4 and 5. The purpose is to illustrate how to measure the various notions of segregation that we put forward in the article using a small subsample of data. By way of this illustration, we believe that an interested reader would be able to implement our methods with a simple hand-held calculator or a spreadsheet computer program.[13]

Two caveats need to be borne in mind. First, the small subsample of data contains only three age groups—people aged 25, 40 and 55—and three cross-sections—the years

[13]To apply these methods to the full dataset, we use the computer program written by Mora (2014) for the statistical software `Stata`.

1993, 2003 and 2013. Second, in the small subsample of data, we aggregate the occupational classifications into three major categories: male, integrated and female occupations. Consequently, the results obtained with the small subsample of data and with the full dataset—which contains $A = 54$ age groups, $T = 21$ cross-sections and the occupational classification at the minor group level—do not coincide fully.

Results reported in the other Appendixes of this supplementary material and in the main manuscript are not based on the small subsample of data. We only use the small subsample of data in (a) the Data section of the main manuscript to provide descriptive statistics and (b) this Appendix B to illustrate the implementation of our methods with numerical examples.

Information, entropy and the M index of segregation

To illustrate the concept of information that, in information theory, is measured by the function $\log\left(\frac{1}{p_q}\right)$, let L be the set of labor market involvement categories, indexed by $l = 1 \ldots L$. Denote by $P^{L|\text{men}}_{1993,40}$ the distribution in 1993 of working 40-year-old men across the four degrees of time involvement in the labor market that we consider (see column 1 of Table 3). An overwhelming 82.1% is engaged in full-time employment. Therefore, if we sampled one man in paid employment and he happened to work full time, we would not be very surprised because the amount of information gained is small: $\log\left(\frac{1}{0.821}\right) \approx 1.2$. On the contrary, if we sampled a man who only works marginal hours, a less likely event, the amount of information obtained is $\log\left(\frac{1}{0.011}\right) \approx 93.5$, or approximately $\frac{93.5}{1.2} = 76.9$ times larger.

Based on this idea of information, using natural logarithms and the values reported in column 1 of Table 3 in 1993, we calculate the entropy of the distribution of employed men aged 40 across the four degrees of labor market involvement: $\text{E}\left(P^{L|\text{men}}_{1993,40}\right) = \sum p_l \log\left(\frac{1}{p_l}\right) = 0.625$. For women $\text{E}\left(P^{L|\text{women}}_{1993,40}\right) = 1.205$, which is $\left(\frac{1.205}{0.625} - 1\right) \times 100 = 193\%$ larger than men's—a result reflecting that women are more "mixed up" across the four degrees of time involvement than men. Finally, if we do not know the gender of the worker, the entropy of the distribution is $\text{E}\left(P^{L}_{1993,40}\right) = 1.014$.

Once we have the necessary entropies, we can calculate the M index of segregation using expression (18). For example, the level of time segregation that there is among the women and men aged 40 in 1993 is:

$$\begin{aligned} TS\left(40,1993\right) &= \mathrm{E}\left(P_{1993,40}^{L}\right) - \left[p_{\text{woman}} \times \mathrm{E}\left(P_{1993,40}^{L|\text{women}}\right) + \left(1-p_{\text{woman}}\right) \times \mathrm{E}\left(P_{1993,40}^{L|\text{men}}\right)\right] \\ &= 1.014 - \left[0.473 \times 1.205 + 0.527 \times 0.625\right] = 0.114. \end{aligned}$$

Recall that Table 3 includes the years 2003 and 2013. The corresponding values are $TS\left(40,2003\right) = 0.098$ and $TS\left(40,2013\right) = 0.097$. We conclude that gender differences in the time involvement of paid work of 40-year-olds decreased somewhat over the first decade spanned by the study period, 1993 to 2003, but became fairly stable during the second decade.

Decomposition of market segregation

First, we calculate market segregation using the decomposition in equation (4). In column 3, panel (b) of Table 3, we have that $p_{\text{Marginal}}^{40,1993} = 0.054$, $p_{\text{Half Time}}^{40,1993} = 0.220$, $p_{\text{Reduced}}^{40,1993} = 0.100$ and $p_{\text{Full time}}^{40,1993} = 0.626$. Moreover, using the three occupational groupings in Table 4, we have that $O\left(40,1993,\text{Marginal}\right) = 0.116$, $O\left(40,1993,\text{Half time}\right) = 0.151$, $O\left(40,1993,\text{Reduced}\right) = 0.223$ and $O\left(40,1993,\text{Full time}\right) = 0.135$. We already know that $TS\left(40,1993\right) = 0.114$. Thus, the level of market segregation among the forty-year-olds in 1993 is:

$$\begin{aligned} MS\left(40,1993\right) &= TS\left(40,1993\right) + \sum_{l=1}^{4} p_{l}^{40,1993} \times O\left(40,1993,l\right) \\ &= 0.114 + \left[0.054 \times 0.116 + 0.220 \times 0.151 + 0.100 \times 0.223 + 0.626 \times 0.135\right] \\ &= 0.114 + 0.146 = 0.26. \end{aligned}$$

The within term $O^{W}\left(40,1993\right) = 0.146$ is the part of market segregation that is *exclu-*

sively due to the different distribution across occupations of the women and men aged 40 in 1993.

Second, we calculate market segregation by using the decomposition in equation (5). Consider again the example with $a = 40$ and $t = 1993$. Then, $O(40, 1993) = 0.212$. This index of segregation quantifies the amount of discrepancy that there is between the distributions of these women and men across male, integrated and female occupations. (The original distributions are in columns 1 and 2 of Panel (b) in Table 4.)

To calculate the within term in equation (5), we use the percentages listed in column 3 of Panel (b) in Table 4 divided by 100: $p_{\text{Male}}^{40,1993} = 0.495$, $p_{\text{Integrated}}^{40,1993} = 0.052$ and $p_{\text{Female}}^{40,1993} = 0.453$. The corresponding indexes of time segregation for each j occupation, with $j \in \{\text{male}, \text{integrated}, \text{female}\}$, are $TS\,(40, 1993, \text{male}) = 0.026$, $TS\,(40, 1993, \text{integrated}) = 0.063$ and $TS\,(40, 1993, \text{female}) = 0.071$. Therefore,

$$\begin{aligned} MS\,(40, 1993) &= O\,(40, 1993) + \sum_{j=1}^{3} p_j^{40,1993} \times TS\,(40, 1993, j) \\ &= 0.212 + [0.495 \times 0.026 + 0.052 \times 0.063 + 0.453 \times 0.071] \\ &= 0.212 + 0.048 = 0.260. \end{aligned}$$

The interaction term

Following equation (6), in the ongoing example for 40-year-olds in 1993, the value of the interaction term is:

$$\begin{aligned} \Delta\,(40, 1993) &= MS\,(40, 1993) - \left[O^W\,(40, 1993) + TS^W\,(40, 1993)\right] \\ &= 0.26 - [0.146 + 0.048] = 0.066. \end{aligned}$$

Gender segregation

Column 3 of Panel (b) in Table 5 shows that $p_w^{40,1993} = 0.802$. Moreover, $ES\,(40, 1993) = 0.054$. We already know that $TS\,(a,t) = 0.114$ and $O^W\,(a,t) = 0.146$. Hence, according to equation (10), in 1993 the level of gender segregation among 40-year-old women and men is:

$$G\,(40, 1993) = 0.054 + 0.802 \times [0.114 + 0.146] = 0.054 + 0.208 = 0.262.$$

Identification of the age effect

Applying equation (24) to people who were 40 in 1993, 2003 and 2013, the between term is $Y^B\,(40) = 0.000184$. We then follow two intermediate steps to calculate the within term. First, we need to know the proportions of 40-year-olds in each of the cross-sections of the small subsample of our data. These proportions are $p_{1993}^{40} = 0.291$, $p_{2003}^{40} = 0.374$ and $p_{2013}^{40} = 0.335$. Next, we calculate the value of gender segregation for each combination of age and year following equation (10):

$$\begin{aligned} G\,(40, 1993) &= 0.054 + 0.802 \times [0.114 + 0.146] = 0.262. \\ G\,(40, 2003) &= 0.032 + 0.823 \times [0.098 + 0.154] = 0.239. \\ G\,(40, 2013) &= 0.020 + 0.823 \times [0.097 + 0.127] = 0.205. \end{aligned}$$

Finally, according to equation (24), the value of the gender-cum-year segregation between women and men who are 40 in the small subsample of our data is:

$$\begin{aligned} G\,(40) &= Y^B\,(40) + G^W\,(40) \\ &= 0.000184 + [0.291 \times 0.262 + 0.374 \times 0.239 + 0.335 \times 0.205] = \\ &= 0.000184 + 0.235 = 0.235. \end{aligned}$$

Replicating the previous calculations for $a = 55$ in the years 1993, 2003 and 2013, we obtain that $G(55) = Y^B(55) + G^W(55) = 0.000159 \; + \; 0.219 = 0.219$. For the sake of interpretability, we multiply the within terms by 100 and conclude that both gender-cum-year segregation and gender segregation decrease from 23.5 to 21.9 points over the middle part of the life course, as people age past 40 and turn 55.

Appendix C Robustness check

Our research strategy requires many cross-sections to ensure that the sample size is sufficiently large to accurately compute the indexes for any given age a net of cohort and period effects. However, one drawback of analyzing a 21-year period is that the distributions of women and men across economic statuses, degrees of labor market involvement and occupations vary to a certain extent, as shown in the Data section.

[Figure 7 about here.]

We therefore need to presume that the age profile of segregation is constant. In other words, once we order the segregation index values by age, a pattern emerges. Our assumption is that the pattern remains stable across the 1993–2013 period. Is this assumption reasonable? Are our findings on segregation patterns over the life course robust to the demographic changes that have occurred in British society? To evaluate whether they are, we replicate the analyses using two narrower samples that contain only the first and last five years of the original period. Figure 7 summarizes the results of this robustness check.

Comparing Figures 5 and 7 shows that the only remarkable change over the two decades under study is that all types of segregation are somewhat larger at the start of the period. The fact that segregation is decreasing over calendar time does not affect the patterns in segregation that we identify over the life course.

Appendix D Indexes and overall employment rates

Table 10 includes the indexes and overall employment rates for ages 16 to 69 that we have graphed in Figures 1, 2, 3, 5 and 6.

[Table 10 about here.]

[Table 11 about here.]

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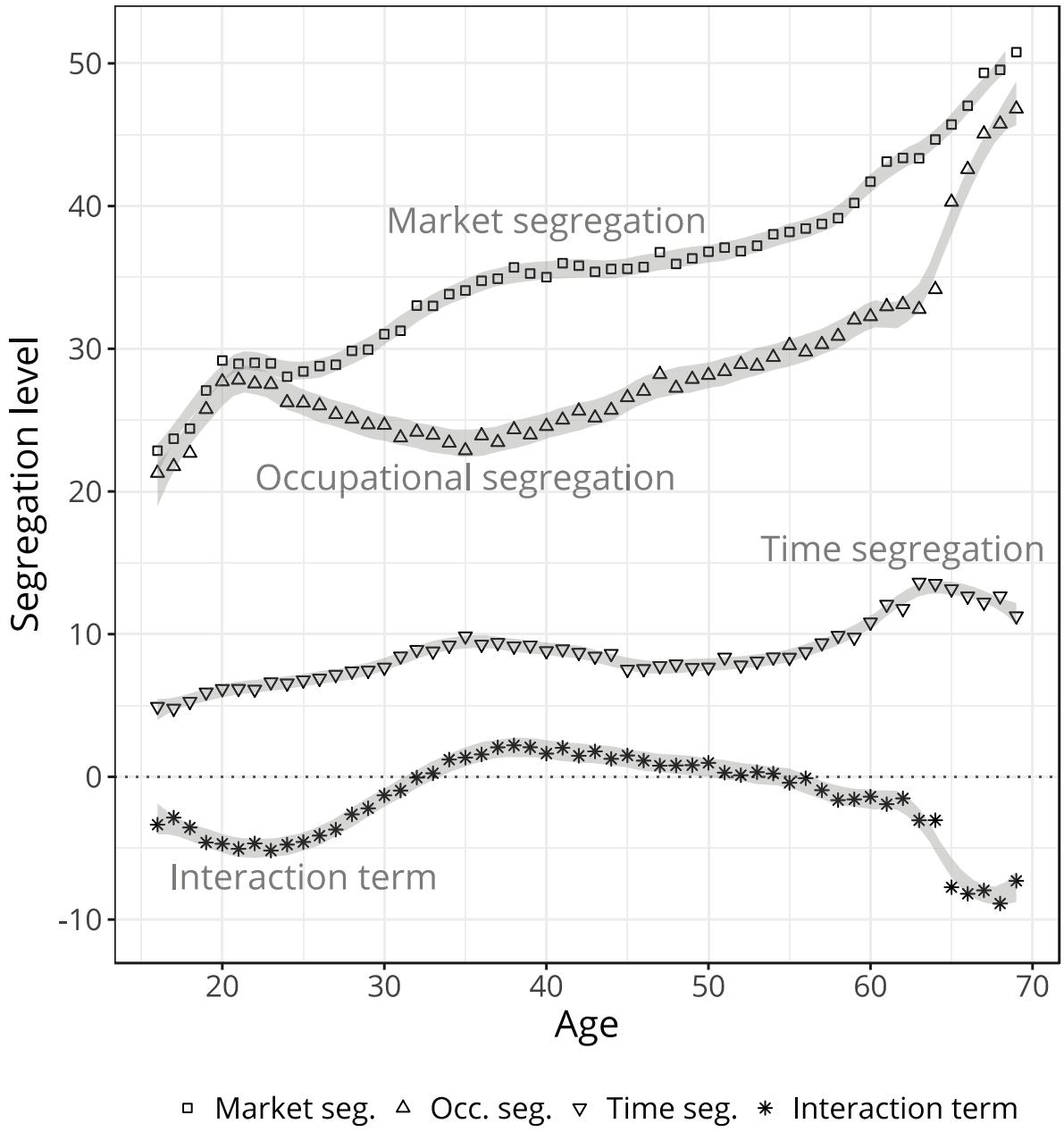

FIG. 1 .— The evolution of market segregation and its components—as defined in equation (15)—over the life course. Data are from the spring quarter LFS (1993–2013). Lines and their shaded 99% confidence intervals are the result of estimating local linear regressions of the indexes on age.

FIG. 2 .— The evolution of gender segregation over the life course and its decomposition as defined in equation (12) and of the employment rate (p_w^a) represented by p in graph (a). Data are from the spring quarter LFS (1993–2013). Lines and their shaded 95% confidence intervals are the result of estimating local linear regressions of the indexes on age.

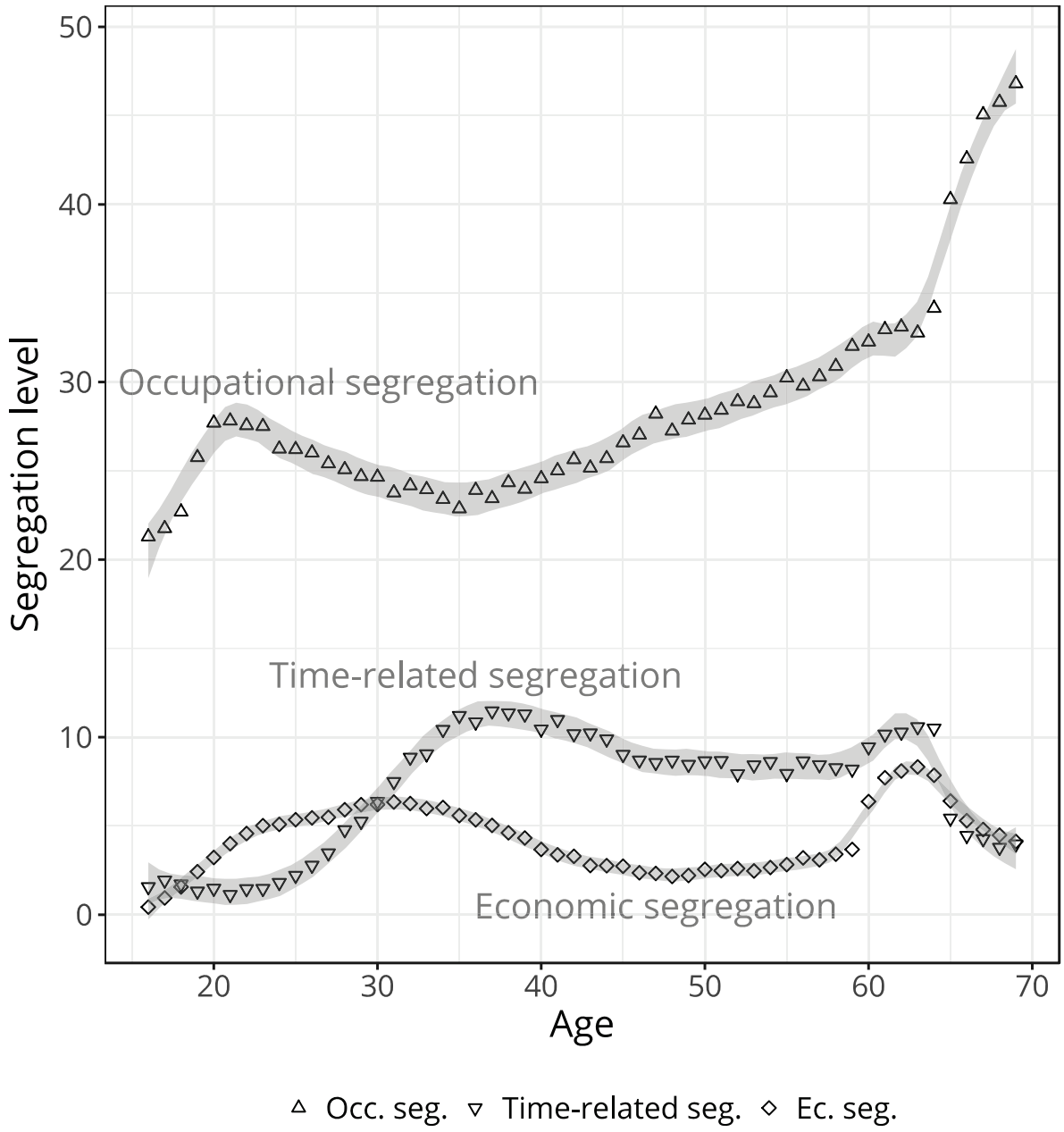

FIG. 3 .— The evolution over the life course of (a) occupational segregation, (b) time-related segregation in the market, and (c) economic segregation. Data are from the spring quarter LFS (1993–2013). Lines and their shaded 99% confidence intervals are the result of estimating local linear regressions of the indexes on age.

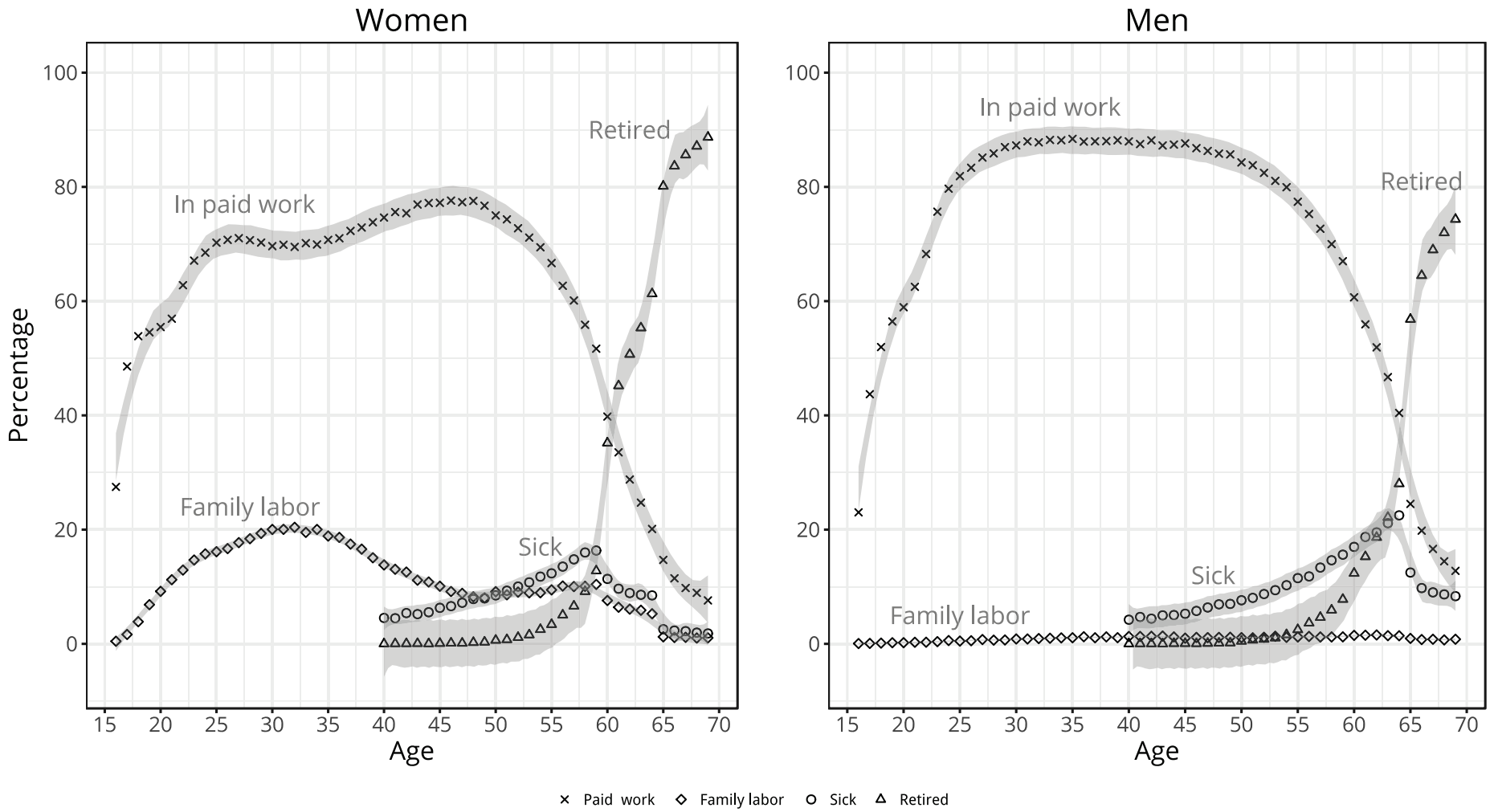

FIG. 4 .— Economic status by age. Data are from the spring quarter LFS (1993–2013). Lines and their shaded 99% confidence intervals are the result of estimating local linear regressions of the percentages on age.

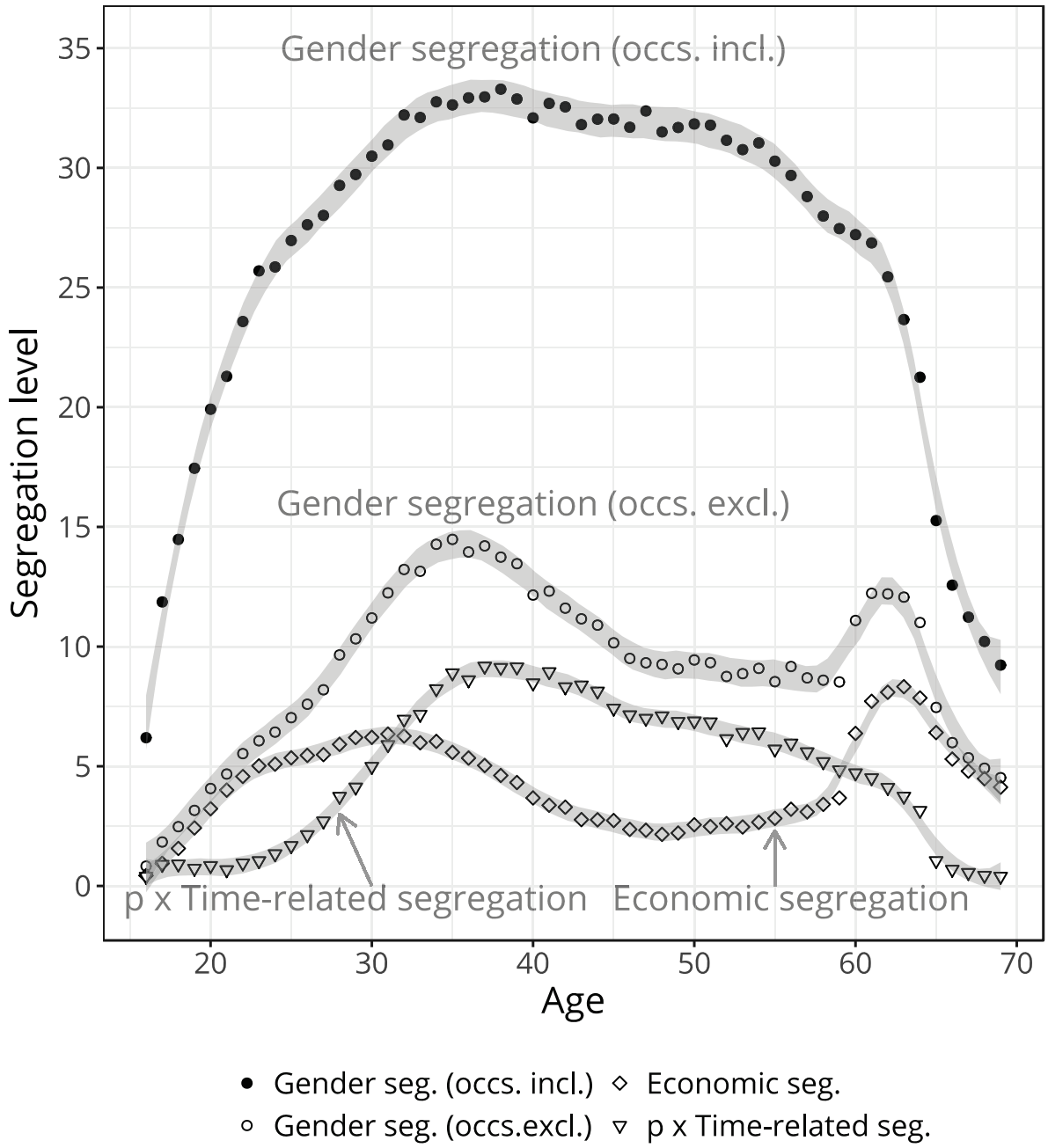

FIG. 5 .— The evolution of gender segregation including and excluding occupations. Occupations are included in equation (13). In the counterfactual scenario (occupations excluded), we set the term $O^W(a)$ to zero as in equation (17), where the employment rate (p_w^a) is represented by p in the Figure. Data are from the spring quarter LFS (1993–2013). Lines and their shaded 95% confidence intervals are the result of estimating local linear regressions of the indexes on age.

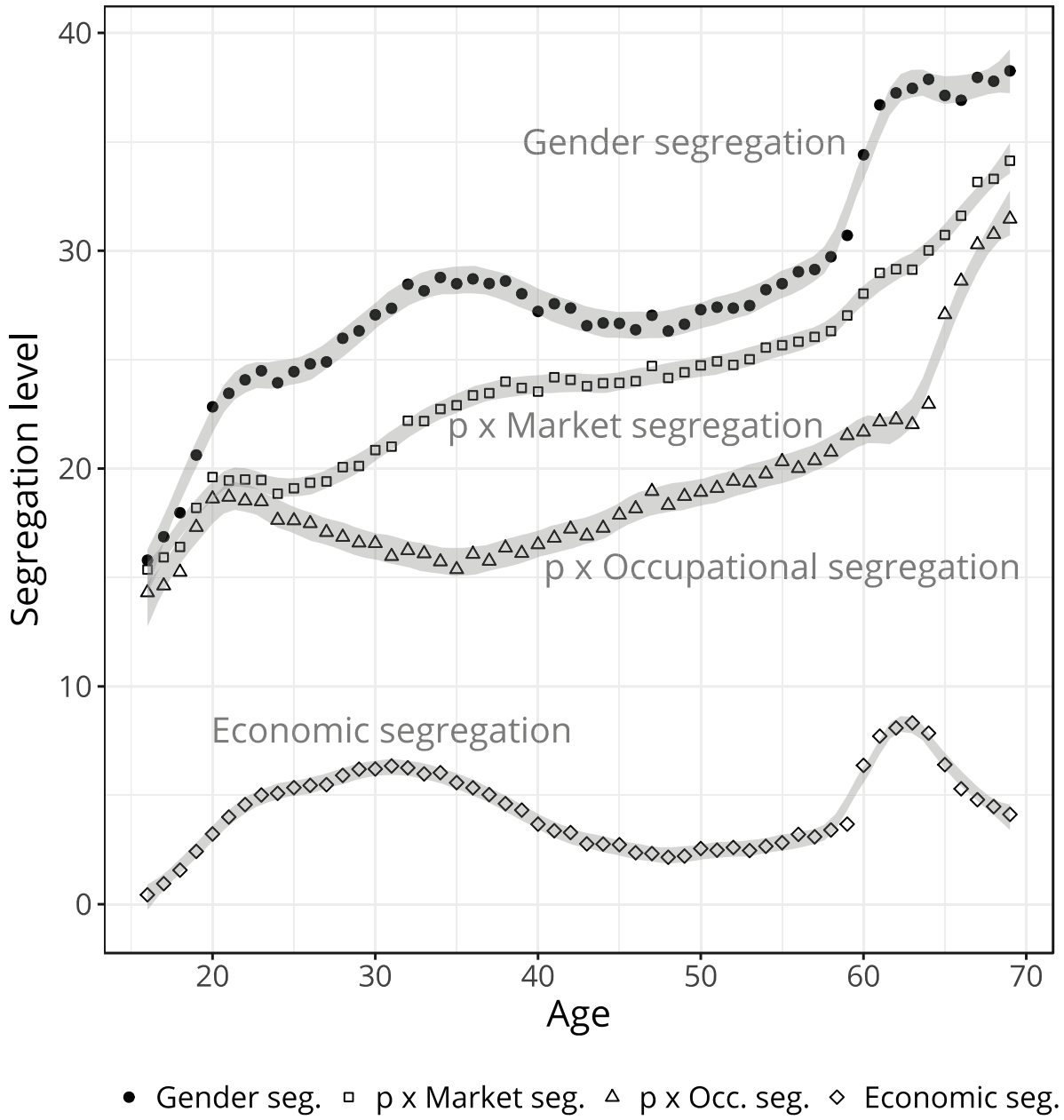

FIG. 6 .— The evolution of gender segregation over the life course with the employment rate (p) set to its mean value (0.672) in equation (12). Data are from the spring quarter LFS (1993–2013). Lines and their shaded 95% confidence intervals are the result of estimating local linear regressions of the indexes on age.

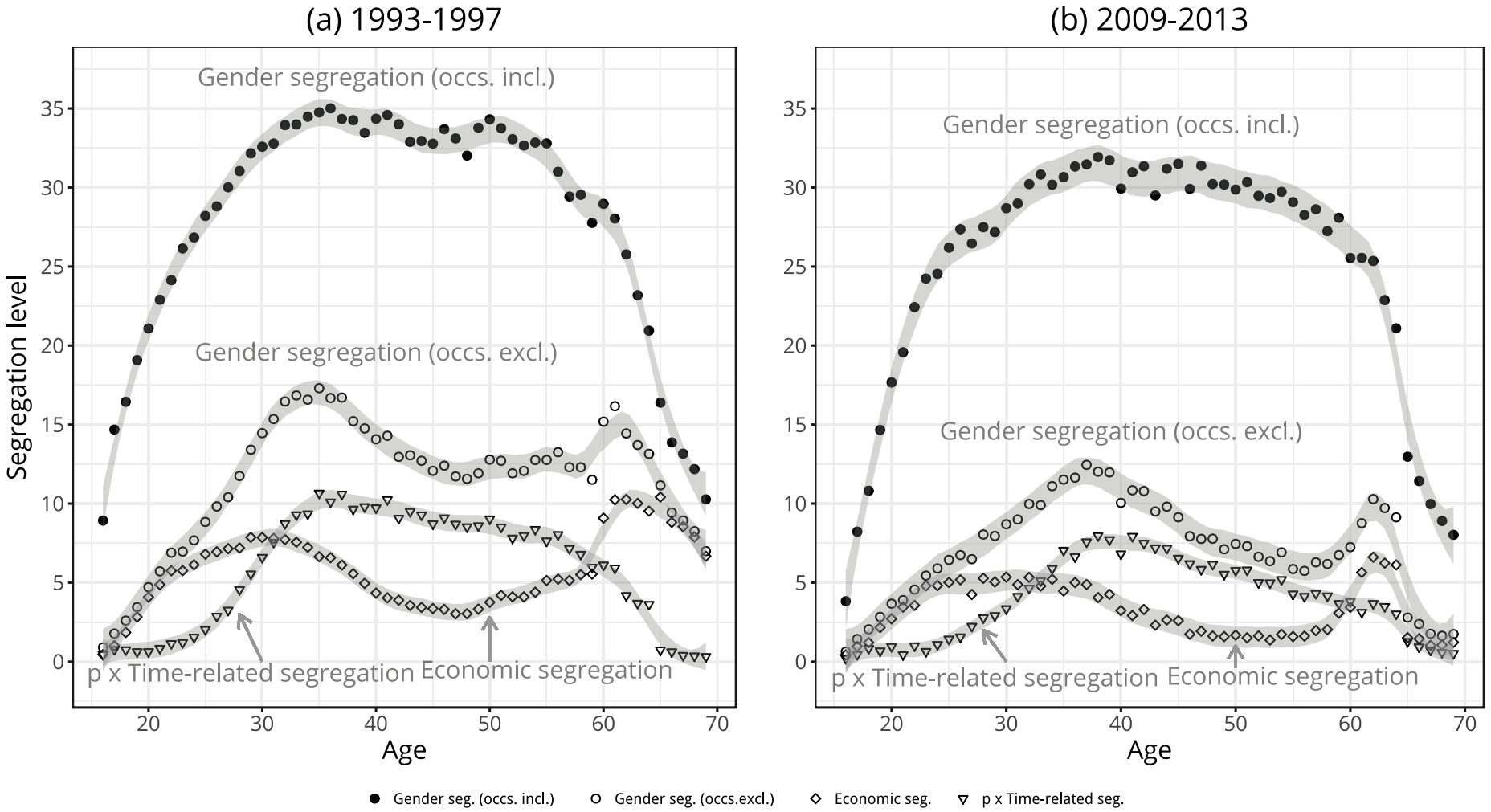

FIG. 7 .— The evolution of gender segregation including and excluding occupations in the first (1993–1997) and last years (2009–2013) of the spring quarter LFS. Occupations are included in equation (13). In the counterfactual scenario (occupations excluded), we set the term $O^W(a)$ to zero as in equation (17), where the employment rate (p_w^a) is represented by p in the Figure. Lines and their shaded 95% confidence intervals are the result of estimating local linear regressions of the indexes on age.

Table 1

The sources of segregation in our research design

	Economic statuses	**Job characteristics**
Active population	1. Employed in jobs	J occupations
		L degrees of time involvement
	2. Unemployed	
Inactive population	3. Family labor	
	4. Studying	
	5. Permanently sick	
	6. Retired	

Table 2
Identification of the Age Effect

	Independent cross-sections		
	(1)	(2)	(3)
Age groups	Young	Young	Young
	Middle-aged	Middle-aged	Middle-aged
	Older	Older	Older

Table 3

Degree of labor market involvement by year and gender

	1993			2003			2013		
	Women	Men	All	Women	Men	All	Women	Men	All
Panel a. People aged 25.									
Marginal hours	5.5	2.1	3.7	4.7	2.5	3.6	3.5	2.5	2.9
Half time	20.2	5.8	12.8	19.1	10.1	14.3	26.7	7.9	16.0
Reduced full time	10.8	8.4	9.6	12.1	11.9	12.0	9.2	9.4	9.3
Full time	63.5	83.7	73.8	64.1	75.5	70.1	60.5	80.2	71.7
Total column %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Population size	298,174	313,712	611,886	237,681	267,452	505,133	274,948	361,214	636,162
Count	801	798	1,599	494	485	979	373	384	757
Panel b. People aged 40									
Marginal hours	10.2	1.1	5.4	8.2	1.4	4.6	6.5	1.4	3.7
Half time	38.2	7.5	22.0	36.8	7.8	21.3	37.4	9.4	22.3
Reduced full time	10.7	9.3	10.0	11.2	7.4	9.14	13.7	5.6	9.3
Full time	40.9	82.1	62.6	43.8	83.4	65.0	42.4	83.6	64.7
Total column %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Population size	272,872	303,569	576,441	352,878	406,021	758,899	312,463	367,955	680,418
Count	761	844	1,605	805	853	1,658	521	570	1,091
Panel c. People aged 55									
Marginal hours	8.8	1.1	4.6	10.2	2.2	5.9	5.6	2.7	4.1
Half time	42.7	7.7	23.5	34.8	10.5	21.9	30.0	11.7	20.8
Reduced full time	10.0	10.2	10.1	12.1	9.6	10.8	16.1	6.3	11.2
Full time	38.5	80.9	61.9	42.9	77.7	61.4	48.4	79.3	63.8
Total column %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Population size	165,962	202,999	368,961	284,786	322,738	607,524	286,154	283,829	569,983
Count	452	546	998	651	705	1,356	506	484	990

Note.—Working marginal hours entails 10 hours or fewer of paid work; half time, 11 to 29; reduced full time, 30 to 34; and full time, 35 or more. Data are from the spring quarter LFS (1993–2013). Population size and percentages are weighted estimates. Counts are the sample sizes.

Table 4

Sex–typed occupations by year and gender

	1993			2003			2013		
	Women	Men	All	Women	Men	All	Women	Men	All
Panel a. People aged 25.									
Male occupations	12.8	69.7	42.0	10.5	60.0	36.7	11.6	62.0	40.2
Integrated	2.7	2.6	2.7	11.7	12.2	12.0	11.4	12.0	11.7
Female occupations	84.5	27.7	55.4	77.8	27.8	51.3	76.9	26.0	48.0
Total column %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Population size	298,174	313,712	611,886	237,681	267,452	505,133	274,948	361,214	636,162
% of population	48.7	51.3	100.0	47.1	52.9	100.0	43.2	56.8	100.0
Count	801	798	798	494	485	485	373	384	384
Panel b. People aged 40									
Male occupations	17.5	78.3	49.5	13.5	72.4	45.0	15.3	67.3	43.4
Integrated	5.0	5.3	5.2	8.8	9.7	9.3	13.9	14.5	14.3
Female occupations	77.5	16.4	45.3	77.7	17.9	45.7	70.8	18.2	42.3
Total column %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Population size	272,872	303,569	576,441	352,878	406,021	758,899	312,463	367,955	680,418
% of population	47.3	52.7	100.0	46.5	53.5	100.0	45.9	54.1	100.0
Count	761	844	844	805	853	853	521	570	570
Panel c. People aged 55									
Male occupations	13.2	79.2	49.5	12.6	72.9	44.6	9.9	71.3	40.4
Integrated	4.5	4.6	4.6	7.6	7.5	7.6	10.1	10.5	10.3
Female occupations	82.3	16.1	45.9	79.8	19.6	47.8	80.0	18.3	49.3
Total column %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Population size	165,962	202,999	368,961	284,786	322,738	607,524	286,154	283,829	569,983
% of population	45.0	55.0	100.0	46.9	53.1	100.0	50.2	49.8	100.0
Count	452	546	546	651	705	705	506	484	484

Note.—*% of population* is a row percentage representing the share of population (in this case, the population in paid work only) that is either male or female. The other percentages in the table are column percentages for the distribution of women and men across male, integrated and female occupations. For a given age and year, women make up a share of the employed labor force. Integrated occupations have a percentage of female workers that is ±5% of the percentage of women in the employed labor force. Female and male occupations are defined by the percentage of women in the employed labor force ±5%. Data are from the spring quarter LFS (1993–2013). Population size and percentages are weighted estimates. Counts are the sample sizes.

Table 5

Economic status by year and gender

	1993			2003			2013		
	Women	Men	All	Women	Men	All	Women	Men	All
Panel a. People aged 25.									
In paid work	65.1	78.8	71.5	71.3	83.8	77.4	69.1	77.7	73.8
Unemployed	6.3	14.4	10.1	4.7	4.9	4.8	6.2	11.2	8.9
In family labor	21.1	0.8	11.7	17.1	0.7	9.1	14.8	0.2	6.9
Retired	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Student	1.9	3.3	2.5	3.4	5.7	4.5	6.3	5.3	5.8
Sick	1.9	1.1	1.5	0.4	2.6	1.5	1.3	4.7	3.1
Other	3.7	1.6	2.7	3.1	2.4	2.7	2.3	0.9	1.5
Total column %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Population size	458,319	398,040	856,359	333,344	319,275	652,619	397,769	464,684	862,453
% of population	53.5	46.5	100.0	51.1	48.9	100.0	46.1	53.9	100.0
Count	1,226	1,002	2,228	691	575	1,266	534	493	1,027
Panel b. People aged 40									
In paid work	73.7	87.1	80.2	75.6	89.3	82.3	77.0	87.6	82.3
Unemployed	4.0	7.7	5.8	2.7	3.3	3.0	3.7	3.9	3.8
In family labor	15.2	0.4	8.0	13.5	1.4	7.6	11.4	2.0	6.6
Retired	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Student	1.1	0.4	0.8	0.6	0.6	0.6	1.2	0.8	1.0
Sick	3.8	3.9	3.8	5.0	3.1	4.1	4.8	4.5	4.6
Other	2.2	0.5	1.4	2.5	2.4	2.5	2.0	1.2	1.6
Total column %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Population size	370,210	348,475	718,685	467,076	454,874	921,950	405,984	420,272	826,256
% of population	51.5	48.5	100.0	50.7	49.3	100.0	49.1	50.9	100.0
Count	1,036	966	2,002	1,061	951	2,012	681	652	1,333
Panel c. People aged 55									
In paid work	56.9	71.7	64.2	68.9	79.3	74.1	74.0	80.8	77.2
Unemployed	3.6	10.4	7.0	1.2	3.7	2.4	3.6	3.9	3.7
In family labor	14.6	1.0	7.9	7.6	1.1	4.4	7.2	1.8	4.6
Retired	3.7	2.0	2.9	4.0	2.2	3.1	2.0	2.4	2.2
Student	0.3	0.0	0.1	0.2	0.1	0.2	0.0	0.0	0.0
Sick	12.4	12.1	12.3	13.2	12.0	12.6	8.4	9.3	8.8
Other	8.6	2.7	5.7	4.8	1.7	3.3	4.8	1.9	3.4
Total column %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Population size	291,902	283,150	575,052	413,321	407,039	820,360	386,630	351,435	738,065
% of population	50.8	49.2	100.0	50.4	49.6	100.0	52.4	47.6	100.0
Count	793	759	1,552	943	892	1,835	681	595	1,276

Note.—*% of population* is a row percentage representing the share of the entire population of a given age that is either female or male. The other percentages in the table are column percentages for the distribution of women and men across categories of economic status. Data are from the spring quarter LFS (1993–2013). Population size and percentages are weighted estimates. Counts are the sample size.

Table 6
Coming of Age (Selected Ages)
Key Percentages by Gender and Segregation Indexes

	Age 16		Age 21	
	Women	Men	Women	Men
Panel a. Economic Status				
Employed	27.5	23.0	56.9	62.5
Unemployed	9.8	10.6	8.0	13.6
Family labor	0.5	0.1	11.2	0.3
Retired	0.0	0.0	0.0	0.0
Studying	56.7	59.9	19.3	18.9
Sick	0.5	0.6	1.4	1.8
Other	5.1	5.8	3.1	3.0
Total	100.0	100.0	100.0	100.0
Count	17,128	17,972	14,594	14,086
Panel b. Degree of Labor Market Involvement				
Marginal	61.3	50.8	9.4	5.6
Half time	27.1	26.6	26.7	18.5
Reduced	3.1	4.1	10.1	10.0
Full time	8.5	18.6	53.8	65.9
Total	100.0	100.0	100.0	100.0
Panel c. Sex-typed Occupations				
Male	15.7	57.0	10.0	56.1
Integrated	2.6	2.4	7.8	8.1
Female	81.7	40.5	82.2	35.8
Total	100.0	100.0	100.0	100.0
Count	4,917	4,388	8,437	8,972
Panel d. Concepts of Segregation and the Employment Rate (p_w^a)				
Occupational	21.3		27.8	
Time	4.9		6.2	
Interaction	−3.4		−5.1	
Market	22.9		28.9	
$p_w^a \times 100$	25.2		59.7	
$p_w^a \times$ Market	5.8		17.3	
Economic	0.4		4.0	
Gender	6.2		21.3	

Note.—Working marginal hours entails 10 hours or less of paid work; half time, 11 to 29; reduced full time, 30 to 34; and full time, 35 or more. For a given age, women make up a percentage of the employed labor force. Integrated occupations have a percentage of female workers that is ±5% of the percentage of women in the employed labor force. Female (male) occupations have a percentage of female workers greater (smaller) than the percentage of women in the employed labor force +5% (−5%). Data are from the spring quarter LFS (1993–2013). Panels A, B and C list column percentages. Counts are the sample size. Panel D presents segregation indexes net of cohort and period effects for each segregation concept and age. Percentages and indexes are weighted estimates.

Table 7
The Core Working Years (Selected Ages)
Key Percentages by Gender and Segregation Indexes

	Age 30		Age 35		Age 46		Age 49	
	Women	Men	Women	Men	Women	Men	Women	Men
Panel a. Economic Status								
Employed	69.6	87.3	70.7	88.4	77.6	86.8	76.7	85.7
Unemployed	4.5	6.4	3.8	5.1	3.1	4.6	2.8	4.3
Family labor	20.0	0.9	18.9	1.1	9.2	1.1	8.0	1.2
Retired	0.0	0.0	0.0	0.0	0.1	0.0	0.3	0.2
Studying	1.6	1.3	1.2	0.7	0.5	0.3	0.3	0.2
Sick	2.1	2.7	3.2	3.1	6.6	5.8	8.0	7
Other	2.2	1.5	2.2	1.6	2.9	1.4	3.9	1.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Count	19,623	16,970	20,819	18,415	19,571	18,249	18,815	17,762
Panel b. Degree of Labor Market Involvement								
Marginal	6.9	1.3	9.0	1.2	7.1	1.4	7.0	1.6
Half time	29.6	7.8	39.0	7.8	33.7	7.6	33.2	7.6
Reduced	9.7	7.6	10.1	7.6	12.7	7.4	12.4	7.0
Full time	53.8	83.3	41.9	83.4	46.5	83.5	47.4	83.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Panel c. Sex-typed Occupations								
Male	15.0	64.5	18.0	69.7	18.3	76.0	16.3	74.4
Integrated	13.0	13.9	11.7	11.9	6.3	6.3	8.0	8.3
Female	72.0	21.6	70.3	18.4	75.5	17.7	75.7	17.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Count	13,613	14,805	14,703	16,273	15,177	15,860	14,387	15,220

Panel d. Concepts of Segregation and the Employment Rate (p_w^a)				
Occupational	24.6	22.9	27.0	27.9
Time	7.7	9.9	7.6	7.6
Interaction	−1.3	1.4	1.1	0.8
Market	31.0	34.1	35.7	36.3
$p_w^a \times 100$	78.3	79.4	82.1	81.1
$p_w^a \times$ Market	24.3	27.1	29.3	29.5
Economic	6.2	5.6	2.4	2.2
Gender	30.5	32.6	31.7	31.7

Note.—Working marginal hours entails 10 hours or less of paid work; half time, 11 to 29; reduced full time, 30 to 34; and full time, 35 or more. For a given age, women make up a percentage of the employed labor force. Integrated occupations have a percentage of female workers that is ±5% of the percentage of women in the employed labor force. Female (male) occupations have a percentage of female workers greater (smaller) than the percentage of women in the employed labor force +5% (−5%). Data are from the spring quarter LFS (1993–2013). Panels a, b and c list column percentages. Counts are the sample size. Panel d presents segregation indexes net of cohort and period effects for each segregation concept and age. Percentages and indexes are weighted estimates.

Table 8
Growing Older (Selected Ages)
Key Percentages by Gender and Segregation Indexes

	Age 59		Age 60		Age 65		Age 69	
	Women	Men	Women	Men	Women	Men	Women	Men
Panel a. Economic Status								
Employed	51.7	67.0	39.8	60.7	14.7	24.5	7.6	12.8
Unemployed	1.6	4.4	0.8	3.8	0.3	0.9	0.1	0.5
Family labor	10.4	1.2	7.6	1.5	1.2	1.0	1.1	0.8
Retired	12.8	7.8	35.2	12.4	80.1	56.8	88.7	74.3
Studying	0.1	0.0	0.0	0.1	0.0	0.1	0.0	0.0
Sick	16.3	15.6	11.4	17.0	2.6	12.5	1.8	8.3
Other	7.1	4.0	5.2	4.6	1.1	4.3	0.7	3.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Count	15,749	14,505	15,720	14,551	14,835	13,654	13,199	11,833
Panel b. Degree of Labor Market Involvement								
Marginal	12.1	3.7	15.4	4.7	33.1	15.2	41.5	25.1
Half time	39.5	13.3	42.6	15.0	43.0	32.3	42.6	38.8
Reduced	11.7	8.9	10.9	8.2	6.4	8.7	5.3	8.3
Full time	36.7	74.1	31.1	72.2	17.5	43.8	10.6	27.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Panel c. Sex-typed Occupations								
Male	16.7	76.7	17.2	77.3	15.8	72.3	14.9	71.8
Integrated	3.8	3.8	3.5	3.6	10.6	9.7	7.3	6.9
Female	79.4	19.5	79.2	19.1	73.7	18.0	77.8	21.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Count	8,014	9,653	6,125	8,769	2,081	3,244	978	1,473

Panel d. Concepts of Segregation and the Employment Rate (p_w^a)				
Occupational	32.0	32.3	40.3	46.8
Time	9.8	10.8	13.2	11.3
Interaction	−1.6	−1.4	−7.7	−7.3
Market	40.2	41.7	45.7	50.8
$p_w^a \times 100$	59.1	50.0	19.4	10.0
$p_w^a \times$ Market	23.8	20.8	8.9	5.1
Economic	3.7	6.4	6.4	4.1
Gender	27.5	27.2	15.3	9.2

Note.—Working marginal hours entails 10 hours or less of paid work; half time, 11 to 29; reduced full time, 30 to 34; and full time, 35 or more. For a given age, women make up a percentage of the employed labor force. Integrated occupations have a percentage of female workers that is ±5% of the percentage of women in the employed labor force. Female (male) occupations have a percentage of female workers greater (smaller) than the percentage of women in the employed labor force +5% (−5%). Data are from the spring quarter LFS (1993–2013). Panels a, b and c list column percentages. Counts are the sample size. Panel d presents segregation indexes net of cohort and period effects for each segregation concept and age. Percentages and indexes are weighted estimates.

Table 9

THE CONTRIBUTION OF VARIOUS NOTIONS OF SEGREGATION TO GENDER SEGREGATION FOR SELECTED AGES (ROW PERCENTAGES)

Age	Occupational segregation (1)	Time–related segregation (2)	Economic segregation (3)	Total
19	81.9	4.2	13.9	100.0
20	79.6	4.2	16.2	100.0
24	75.1	5.2	19.7	100.0
28	67.0	12.8	20.2	100.0
35	55.6	27.3	17.1	100.0
45	68.3	23.2	8.5	100.0
60	59.2	17.3	23.4	100.0
63	49.0	15.8	35.2	100.0

NOTE.—The percentages in the table are calculated using the terms in equation (13) as follows: (1) occupational segregation, $p_w^a \frac{O^W(a)}{G^W(a)} \times 100$; (2) time-related segregation, $p_w^a \frac{TS^W(a)+\Delta(a)}{G^W(a)} \times 100$; and (3) economic segregation, $\frac{ES(a)}{G^W(a)} \times 100$. Data are from the spring quarter LFS (1993–2013). Sample count: $258,852$.

Table 10

The Evolution of Various Notions of Segregation and of the Employment Rate over the Life Course

Age	Occ.	Time	Int.	Market	Emp.Rate (p_w^a)	$p_w^a \times$ Market	Economic	Gender
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
16	21.3	4.9	-3.4	22.9	25.2	5.8	0.4	6.2
17	21.8	4.8	-2.9	23.7	46.1	10.9	0.9	11.9
18	22.7	5.3	-3.6	24.4	52.9	12.9	1.6	14.5
19	25.8	5.9	-4.6	27.1	55.5	15.0	2.4	17.5
20	27.7	6.2	-4.7	29.2	57.2	16.7	3.2	19.9
21	27.8	6.2	-5.1	28.9	59.7	17.3	4.0	21.3
22	27.6	6.1	-4.7	29.0	65.5	19.0	4.6	23.6
23	27.5	6.6	-5.2	29.0	71.4	20.7	5.0	25.7
24	26.2	6.6	-4.8	28.0	74.1	20.8	5.1	25.9
25	26.2	6.8	-4.6	28.4	76.1	21.6	5.4	27.0
26	26.0	6.9	-4.1	28.8	77.0	22.2	5.5	27.6
27	25.4	7.2	-3.7	28.9	78.0	22.5	5.5	28.0
28	25.1	7.4	-2.6	29.9	78.2	23.4	5.9	29.3
29	24.7	7.5	-2.2	29.9	78.6	23.5	6.2	29.7
30	24.6	7.7	-1.3	31.0	78.3	24.3	6.2	30.5
31	23.8	8.4	-1.0	31.3	78.7	24.6	6.3	31.0
32	24.2	8.9	-0.1	33.0	78.6	25.9	6.3	32.2
33	24.0	8.8	0.2	33.0	79.2	26.1	6.0	32.1
34	23.4	9.2	1.2	33.8	79.0	26.7	6.0	32.8
35	22.9	9.9	1.4	34.1	79.4	27.1	5.6	32.6
36	23.9	9.3	1.6	34.8	79.4	27.6	5.3	32.9
37	23.4	9.4	2.1	34.9	80.0	27.9	5.0	33.0
38	24.3	9.2	2.2	35.7	80.3	28.7	4.6	33.3
39	24.0	9.2	2.1	35.3	81.0	28.6	4.3	32.9
40	24.6	8.8	1.6	35.0	81.1	28.4	3.7	32.1
41	25.0	8.9	2.0	36.0	81.5	29.3	3.4	32.7
42	25.6	8.7	1.5	35.8	81.7	29.3	3.3	32.5
43	25.2	8.4	1.8	35.4	82.0	29.0	2.8	31.8
44	25.7	8.6	1.3	35.6	82.3	29.3	2.8	32.0
45	26.6	7.5	1.5	35.6	82.3	29.3	2.7	32.0
46	27.0	7.6	1.1	35.7	82.1	29.3	2.4	31.7
47	28.2	7.8	0.8	36.8	81.7	30.1	2.3	32.4
48	27.3	7.9	0.8	35.9	81.6	29.3	2.2	31.5
49	27.9	7.6	0.8	36.3	81.1	29.5	2.2	31.7

THE EVOLUTION OF VARIOUS NOTIONS OF SEGREGATION AND OF THE EMPLOYMENT RATE OVER THE LIFE COURSE (CONTINUED)

Age	Occ.	Time	Int.	Market	Emp.Rate (p_w^a)	$p_w^a \times$ Market	Economic	Gender
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
50	28.1	7.7	1.0	36.8	79.6	29.3	2.6	31.8
51	28.4	8.4	0.3	37.1	79.0	29.3	2.5	31.8
52	28.9	7.8	0.1	36.8	77.5	28.5	2.6	31.2
53	28.8	8.1	0.3	37.2	76.0	28.3	2.5	30.8
54	29.4	8.4	0.2	38.0	74.7	28.4	2.7	31.0
55	30.2	8.4	-0.4	38.2	71.9	27.5	2.8	30.3
56	29.8	8.8	-0.1	38.4	68.9	26.5	3.2	29.7
57	30.3	9.4	-0.9	38.7	66.3	25.7	3.1	28.8
58	30.9	9.9	-1.6	39.2	62.8	24.6	3.4	28.0
59	32.0	9.8	-1.6	40.2	59.1	23.8	3.7	27.5
60	32.3	10.8	-1.4	41.7	50.0	20.8	6.4	27.2
61	33.0	12.1	-1.9	43.1	44.4	19.1	7.7	26.9
62	33.1	11.8	-1.5	43.4	40.0	17.4	8.1	25.4
63	32.8	13.6	-3.0	43.3	35.4	15.3	8.3	23.7
64	34.2	13.5	-3.0	44.7	30.0	13.4	7.9	21.3
65	40.3	13.2	-7.7	45.7	19.4	8.9	6.4	15.3
66	42.6	12.7	-8.2	47.0	15.5	7.3	5.3	12.6
67	45.1	12.2	-8.0	49.3	13.0	6.4	4.8	11.2
68	45.8	12.7	-8.9	49.5	11.6	5.7	4.5	10.2
69	46.8	11.3	-7.3	50.8	10.0	5.1	4.1	9.2

NOTE.—This table contains the terms in equations (12) and (13) by year of age. The columns are as follows: (1) occupational segregation or $O^W(a)$; (2) time segregation or $TS^W(a)$; (3) the interaction term or $\Delta(a)$; (4) market segregation or $MS^W(a)$; (5) the employment rate or p_w^a; (6) market segregation weighted by the employment rate or $p_w^a MS^W(a)$; (7) economic segregation or $ES^W(a)$; (8) gender segregation or $G^W(a)$. Data are from the spring quarter LFS (1993–2013). Sample count: $1,815,482$.